THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIX. No. 1775.] LONDON, MAY 18, 1897. [49TH YEAR. PRICE 6d.

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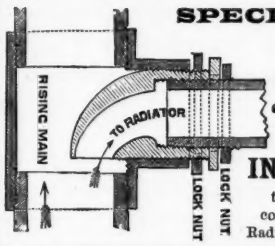

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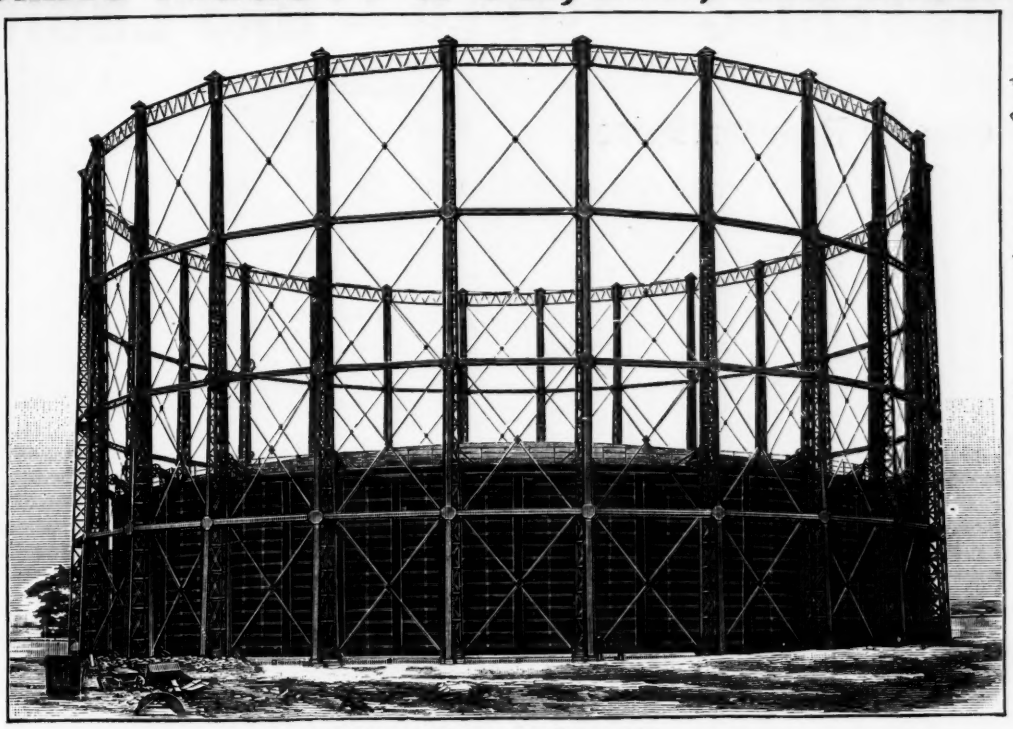

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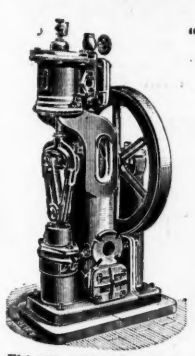

Fig. 705. "SINGLE RAM" STEAM-PUMP.

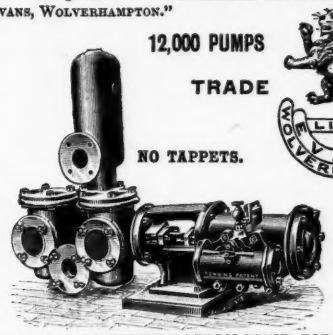

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

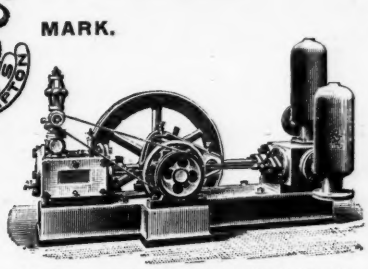

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

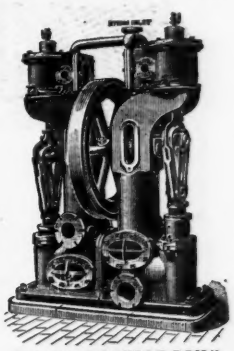

Fig. 712. "DOUBLE-RAM" STEAM-PUMP

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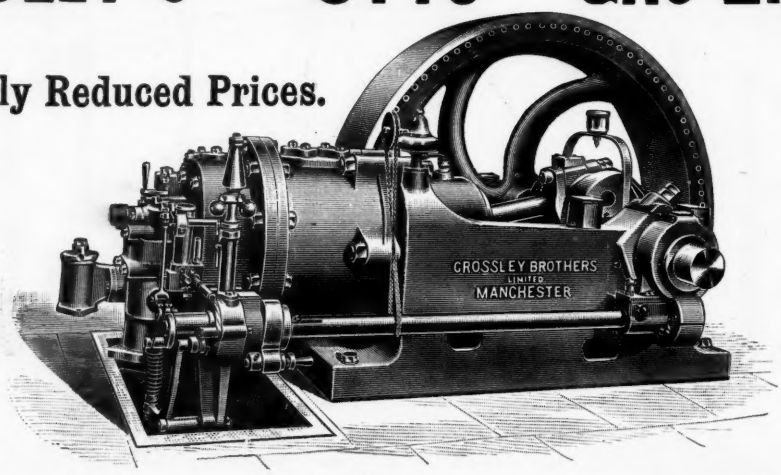

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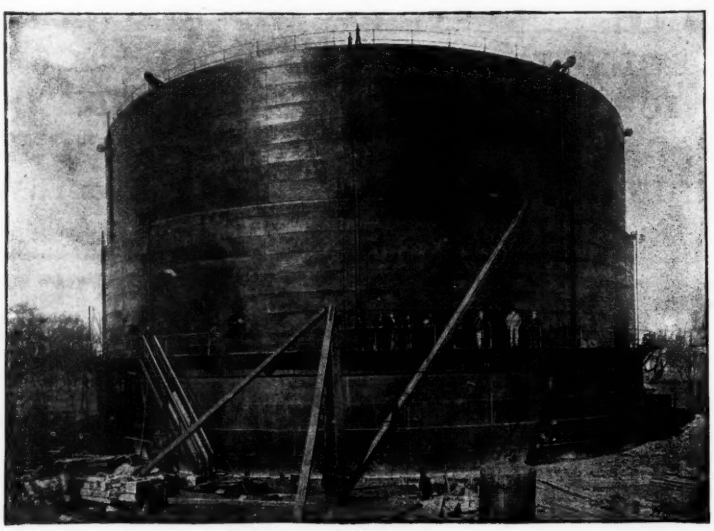

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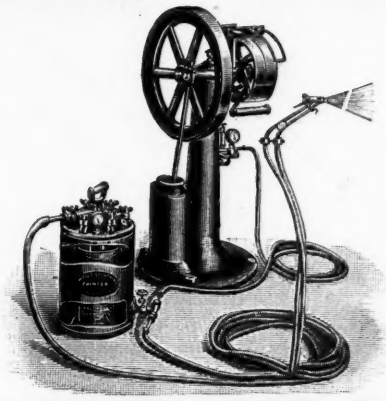

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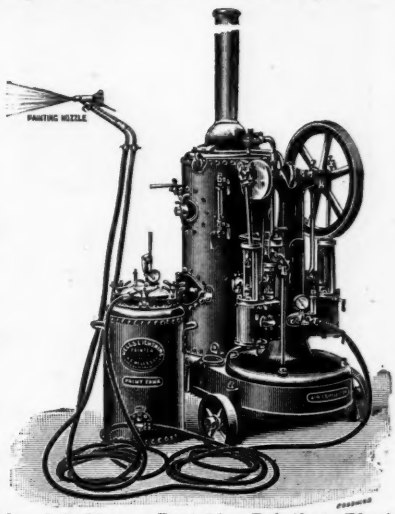

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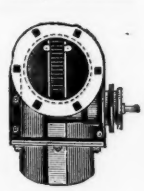

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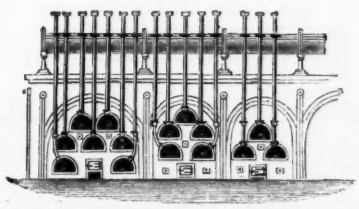

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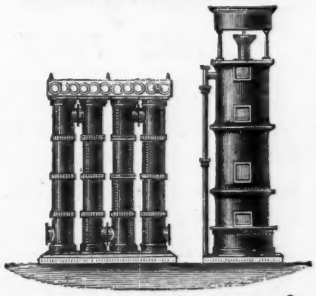

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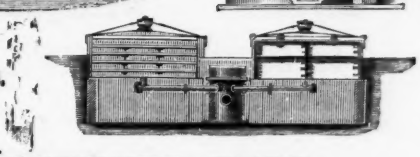

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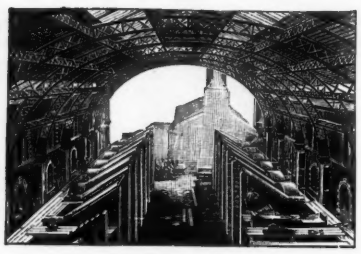

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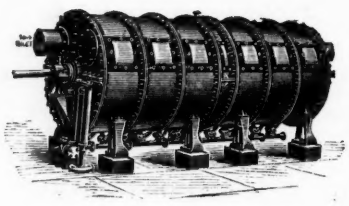

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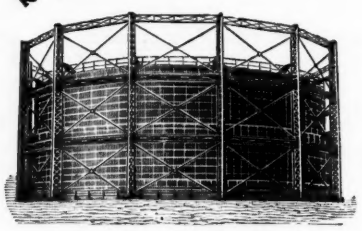

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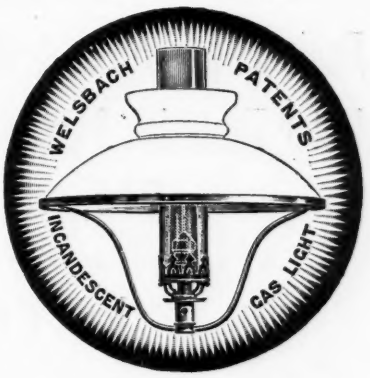

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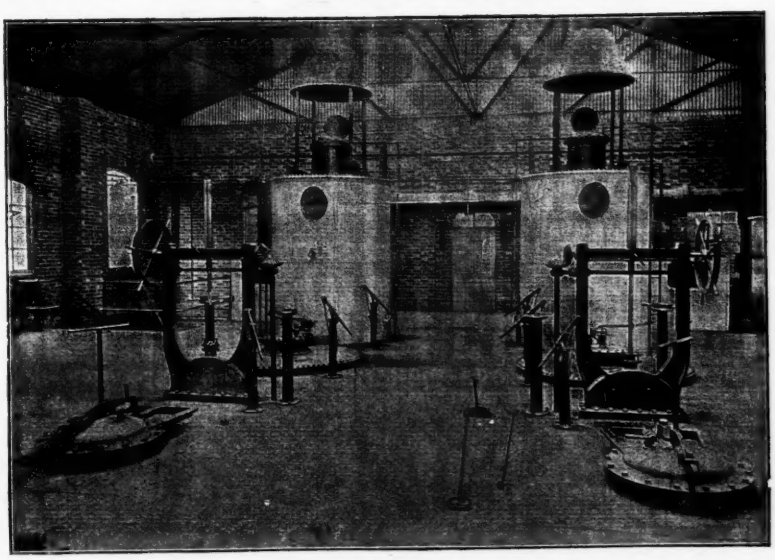

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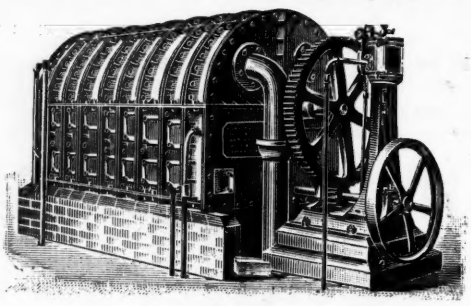

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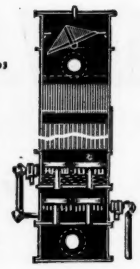

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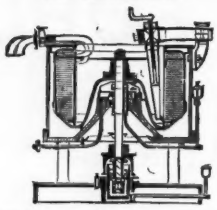

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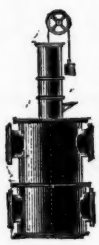

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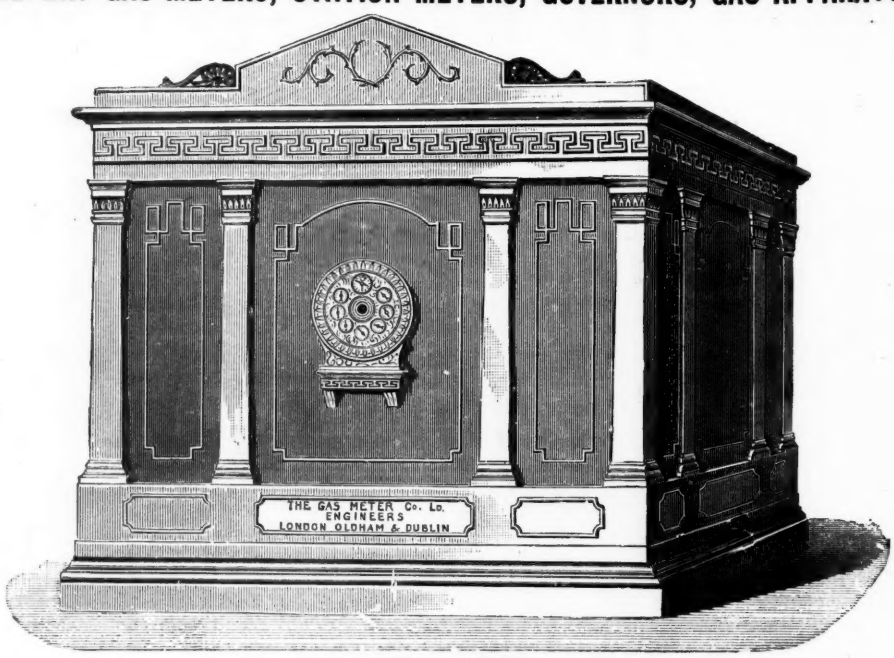

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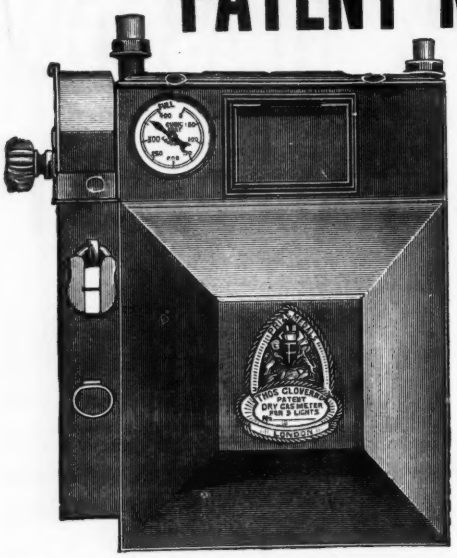

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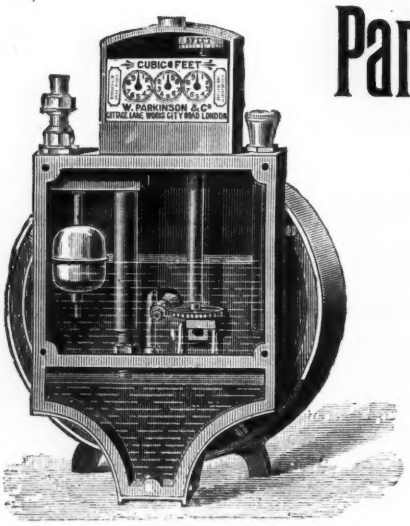

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EDITORIAL NOTES.

The Reform of Scottish Private Bill Legislation.

THE House of Lords on Thursday last did one of those unpretentious pieces of legislative work which now and again redeem the character of the Upper House as a more businesslike assembly than the House of Commons. Lord Balfour of Burleigh brought in a Bill to amend the procedure of Parliament in regard to Scottish Private Bill legislation, and took the opportunity of giving a succinct account of the origin of the present system. This system, which to the present generation seems an integral portion of the Constitution, really dates from 1837. Prior to this epoch, both Houses carried their Private Bill legislation through open Committees of the Whole House. But in the year 1837 the House of Lords initiated a plan of relegating such business to Select Committees constituted of members of the House who had no interest in the subject of the Bill. The same course was followed by the House of Commons seven years later in the case of Railway Bills; but it was not until 1855 that opposed Private Bills were regularly remitted to Select Committees in the House of Commons. This was a great improvement on previous practice; but since that period attempts at further reform have been made at intervals in both Houses. These efforts have proceeded on two main lines. Some have proposed that Private Bills should originate in Parliament, as at present, and the committee stage be taken before some outside permanent tribunal. The usual alternative proposal has been that the whole scheme of Private Bill legislation should be left in the early stages to the outside tribunal, and that the complete schemes only should come before Parliament for confirmation. By both plans Parliament would be relieved of the inconvenience and strain of providing for the proper constitution of Select Committees. In 1869 a palliative scheme was suggested for referring all Private Bills to a Joint Committee of both Houses, so as to make one hearing serve instead of two; but the plan did not meet with much favour. Numerous other suggestions have been offered from time to time, having for their object the saving of the labour of Parliament and of the money of petitioners and opponents. Lord Balfour referred sympathetically to the labours of the late Mr. Craig-Sellar, who made the reform of Private Bill legislation his study during several sessions. Lord Balfour thought, however, that all attempts at a reform of the system failed either upon the question of the tribunal to which the Committee stage of Bills should be referred, upon the question of procedure, or upon the difficulty of defining to what Bills the new procedure should be applied.

Lord Balfour has dealt with the special case of Scottish Private Bill business, presumably on the safe principle that in such a matter it is better to work on the particular than attempt to grapple with the abstract. He told the House that Scotland had taken the cause in hand, and wanted a change for the better. The reasons advanced were the great expense attendant upon the existing system, which is a clog upon enterprise, and the unfairness which the great cost of parliamentary inquiry entails upon the opponents to large schemes who might not have pecuniary means to present their real and serious objections. It is also thought that there are many matters, such as extensions of municipal boundaries, proposals for fresh supplies of water, for tramways, and similar local enterprises, which it seems quite unnecessary to bring to London for adjudication. Yet here again it is generally felt that not the least valuable part of the present system is the general supervision over the tendency of Private Bill legislation which is exercised by the Chairman of Committees of the House of Lords and the Chairman of Ways and Means in the House of Commons. Lord Balfour consequently fell back upon the existing Provisional Order system, as offering the prospect of saving time and expense without escaping from the salutary control of legislation by the permanent parliamentary authorities. He proposes that Scottish Private Bill procedure should be assimilated to that pursued in the case of Provisional Orders.

It will be news to many of our readers, who are accustomed to associate this procedure with the Gas and Water Works Facilities Act, to learn that the system is actually worked by no fewer than 14 Government Departments, under about 30 different Acts of Parliament. During the last ten years, the Board of Trade alone have granted

624 Provisional Orders, only 62 of which have been petitioned against, and of these only 19 were rejected or amended by Parliament. Upon this favourable showing, Lord Balfour proposes to extend the system to all Scottish Private Bill business. According to this plan, opposition, if any, to a Provisional Order would be heard by a tribunal consisting either of a Judge of the Court of Session, a Sheriff selected by the President of the Court of Session, and two lay Commissioners selected from a panel of twelve, who would remain in office for five years. The panel would be selected by the Conveners of County Councils and representatives of boroughs in Scotland. If when a Provisional Order is finally made anyone feels aggrieved, there is to be an appeal to Parliament through the Secretary for Scotland. This is the general idea, as to which Sir Joseph Warner—a high authority—is reported to have stated that this is the best practical scheme for localizing Private Bill legislation that has yet been seriously put forward. The scheme was well received by the House; and the importance of the reform herein sketched out consists in the prospect that, if successful, it will not be limited to Scotland.

Opinion Concerning the Workmen's Compensation Bill.

Upon further consideration of the Workmen's Compensation for Accidents Bill, the political Labour party have decided to support the second reading; and this decision may be accepted as a triumph of good sense over partisan prejudice. The moment the terms of the Government measure were announced, several newspapers hastened to take the opinion of certain prominent Trade Unionists respecting its general tenor; and, as a matter of course, these gentlemen had no hesitation in expressing their conviction that "it would never do." It now appears, however, that they spoke out of book; and no time has been lost by those to whom they are bound to defer, in bringing them into a different frame of mind. Among the most hostile of these critics of the Bill were Mr. Edward Harford, of the Amalgamated Railway Servants, and Mr. Sam Woods, of the Lancashire Miners' Federation. Last week a special meeting of the Parliamentary Committee of the Trade Union Congress was held to consider the Government proposals; and as the result of the meeting Mr. Woods, as Secretary, had to communicate to the Press the information that the Committee had decided to support the principle of the Bill. At the same time the Committee determined to use their best endeavours to procure the extension of the scope of the Bill to other trades and in other ways. This is all right and reasonable, and is a very different policy from that acrid hostility to the whole thing which the individual labour politicians took upon themselves to breathe in advance. Politics seem to have gone by the board this time; for Mr. Asquith, who undertook to pour cold water upon the Government scheme of legislation from his official standpoint as an ex-Minister, has been reminded by the noisiest section of his habitual followers that this is an impossible attitude. The coal miners, it is announced, are in favour of the principle of the Bill. This unanimity is really astonishing, seeing how hopelessly the same interest is divided in regard to some other matters—notably the Miners' Eight Hours Bill. If it were worth while, we might excusably take a little credit to ourselves for so accurately predicting the week before the Bill appeared in print, the lines upon which an acceptable Bill of the kind could be drawn—which forecast was realized to the letter. Such considerations as these, however, are not of the smallest importance beside the main fact that at last a strong body of united opinion has been created by Sir M. White Ridley, and will be available to redress an acknowledged grievance of the industrial community. If the Act passes, the working classes of the country will be in a better position than those of any other nation, and this result will be brought about without the creation of an additional Government Department, and also without, so far as can be seen, providing employment for a single additional middleman, legal or otherwise. If the Imperial Parliament can work off a scheme of this character and magnitude in this year of Jubilee, it will thereby erect a monument to the reign and to its own wisdom more enduring than brass, more beneficent than stone.

Mr. Carulla on Sulphate of Ammonia.

Mr. F. J. R. Carulla has of late been undertaking the duty of championing sulphate of ammonia, with the object of restoring this fertilizer to something like its rightful place in the market and the field. His last effort in this line was a paper presented to the recent annual meeting of the Iron and Steel Institute, specially addressed to those iron-masters who have of late years become large producers of sulphate. The idea of the paper was to convince this class of sulphate manufacturers as to the high value of the product as a fertilizer. To attempt to teach the maker of a commodity that his product is a valuable one, savours somewhat of preaching to the converted; yet doubtless Mr. Carulla is fully justified in holding that the first step towards the rehabilitation of sulphate must be to settle the minds of producers as to the substantial worth of their product. Mr. Carulla reminded his hearers that it used to be generally acknowledged that sulphate of ammonia was 25 per cent. better in fertilizing power than an equal weight of nitrate of soda; but this point would appear to have been given up during the last few years—indeed, those who are more interested in nitrate have even succeeded in creating a prevalent impression that it is the more valuable fertilizer of the two. In these circumstances, the idea occurred to Mr. James O'Sullivan, speaking at a meeting in January last of the Nottingham Section of the Society of Chemical Industry, that the great drawback to the popularity of sulphate of ammonia in this country lies in its name, which does not convey to the untutored mind the idea of there being a large content of nitrogen in the substance. He thought that nitrate of soda has a real advantage in this respect, inasmuch as it proclaims its nitrogenous character, which the name sulphate of ammonia certainly does not. Mr. Carulla was much taken by this suggestion; and he followed it up by proposing that sulphate of ammonia should be put upon the home market under the name of "Nitrogenous Sulphate." A portion of Mr. Carulla's last paper was accordingly devoted to enforcing this suggestion, as to which we are fain to remark that we do not see much in it. If sulphate of ammonia had not received its proper name, by which it is known all the world over, in the ordinary way—if it had happened to be introduced to the world, like some other preparations, under a clumsy or inappropriate name—there would be something more in the notion that its commercial prospects would be improved by renaming it. As the matter stands, however, it is difficult to believe that the British farmer would pay more for sulphate with the word "nitrogenous" added than he is willing or able to pay for the same commodity when invoiced by the name he is familiar with. With more reason Mr. Carulla referred to the experiences of Professor Paul Wagner, of Darmstadt, with nitrogenous dressings in various forms, as indicating the value of sulphate as a source of nitrogen. The chief weakness of the paper was its omission of all reference to the oft-repeated observation of agriculturists at home and abroad that for all-round cropping most soils require something in addition to nitrogenous manure. The author concluded with the suggestion that the British farmer wants nothing more to increase the fertility of his land than basic slag in the autumn and sulphate of ammonia in the spring. This assertion is untenable; and enthusiasts need to be reminded that such one-sided advocacy does little good in the long run.

Another Dublin Persecution.

For the credit of the Dublin Corporation and the public of the Irish capital, it is to be noted that the last vagary of the Corporation Gas Committee in the way of prosecuting, and persecuting, the Alliance and Dublin Consumers' Gas Company has been strongly condemned on all sides. The incident was one of an extraordinary character, and such, we make bold to declare, as could not have occurred in connection with the gas supply of any other town in the United Kingdom. The Act requires the testing-station to be kept open every day, and everywhere else but in Dublin this enactment would, as a matter of course, be interpreted to mean, as the Scotch term has it, every "lawful" day. Some time since, however, the Dublin Gas Committee gave the Company to understand that the testing-station was to be open on Sundays as well. To this demand the Company acceded, outrageous as it was. An extension of the practice was suddenly decided upon by the warlike spirits on the Committee, and on the day before Good Friday the Gas Company were notified that the station would be required on the following day. In vain did the Secretary of the Company write to the Committee pointing out the inconvenience of this proposal, which had only been received after the regular custodian

of the station had left for a brief holiday. The Committee had got the Company in a hole at last; and a prosecution was joyfully ordered by a meeting of three out of the eighteen members of the Committee, with the result that the Company were fined five shillings for the technical offence of not keeping the station open. Seeing that this is the solitary triumph gained by the Gas Committee over the Company during the many years they have been fighting in the Courts and before Parliament, at an expense of tens of thousands of pounds, it would seem churlish to begrudge it to them. One could have wished that each of the victorious party had been able to recover a five-shilling piece from the Company, to wear round his neck. The local Press lost no time in protesting against the absurdity of these proceedings. The "Freeman's Journal" observed next day that "such proceedings are purely "vexatious. They have no real connection with the "advantage of the citizens, and they are only calculated "to bring the administration of the city affairs into con-"tempt. The only thing they prove is that in such "matters the Corporation is still wholly under those in-"fluences which have had so far such unwelcome financial "results to the citizens." At the next meeting of the Corporation, the hole-and-corner character of the resolution to prosecute the Company was exposed and denounced; general disgust being expressed at the action of the minority in taking advantage of a small technical point—as the same newspaper put it, "probably an oversight in "the statute, to rob the unfortunate, hard-worked em-"ployees of the Gas Company of the holiday that all "others are permitted to enjoy in peace." It is difficult to understand the virulence of the partisan feeling that prompts the wire-pullers of the Dublin Corporation Gas Committee to take vengeance upon the Gas Company in this way. The rest of the Corporation must see that these individuals are making the whole Municipality ridiculous in the eyes of the world; and they must also know that these incessant irritations are likely to inspire among the shareholders, consumers, and officials of the Company a spirit of resentment against the Corporation which is as deplorable as it is uncalled for by anything in the natural relations of the two organizations.

An Extraordinary Gas-Works Nuisance Case.

In another column will be found the commencement of a report of certain legal proceedings which are of a most unusual character. We have already reported in the ordinary way the litigation between a Mr. W. O. Ward and the Plymouth Gas Company in respect of the existence of an alleged nuisance on the Company's works, from which Mr. Ward claimed to have suffered damage in his business as a tanner. The complaint arose in connection with a new extension of the Company's works, consisting of a retort-house fitted with West's mechanical stoking plant—Mr. Ward alleging that since the new retort-house had been set to work such a nuisance had arisen, in the shape of dust and smoke, as to render it impossible for him to carry on his business. This business had been in operation for twenty years on premises adjoining the gas-works; and it was only with the erection of the new carbonizing plant that trouble came. At the trial of the action, the Company submitted to an order by consent, which admitted the nuisance. An inquiry as to damages was held on the spot in April, 1896, and the Company were ordered to pay £3200. The present inquiry is being conducted by Mr. E. Pollock, the Official Referee, to ascertain how affairs have gone since that period. We have not deemed it necessary to comment upon the litigation so far as it has gone, for the reason that, though the monetary interests involved were considerable, the real or alleged facts were of purely local importance. Now, however, the matter is taking a fresh development; and the question has arisen as to the efficacy of means adopted for obviating the usual concomitants of carbonizing work. There is an obvious side to all nuisance litigation of this kind which cannot be more than alluded to here. In the present case the issue is complicated by certain evidence tending to impeach the *bona fides* of the plaintiff. This suggestion renders the present issue very grave, and imposes the greatest caution upon everybody who has to do with the case. We recommend our readers to peruse the whole of the evidence with particular attention, inasmuch as the business is of a character that any gas manager may be involved in whenever a new retort-house, or sulphate plant, or even a large gasholder, has to be erected. The imputation of nuisance has dogged the gas industry from its earliest days, and is as potent for mischief now as ever it was. Whether the district in which the gas-works are situated is residential, industrial, or agricultural matters little. An action for nuisance is possible, and there is no class of law case more difficult to fight.

WATER AND SANITARY AFFAIRS.

The Conservators of the Thames, in their annual report issued last week, state that their estimates of receipts and expenditure for the river above Staines in respect to the present year show that, for the first time for many years, there is likely to be a substantial balance in favour of revenue. This balance the Conservators propose to expend in additional dredging in parts of the river which are so shallow as to prejudice the navigation, and which also tend to prevent the free escape of flood water. But it is evident that the improved financial condition of the Conservancy is largely due to the moneys received from the London Water Companies. Mention is made of the fact that, under the Staines Reservoirs Act of 1896, the Conservators receive from the Joint Committee of the three Companies concerned a capital sum of £5000, to be applied for the purposes of any works rendered necessary or desirable by reason of the Act. The Conservators propose to expend this money in the construction of a new weir at Penton Hook, about a mile below the town of Staines; and it is explained that the design upon which it is intended to build this weir will include an increased outlet for the escape of flood water from the low-lying districts at Windsor and above that town. These districts will therefore be benefited at the cost of the Water Companies, though it is often complained that the Companies are acting to the detriment of the river. The Conservators are thus assisted in meeting the demand made upon them for the prevention of floods, in reply to which they are accustomed to plead that they are an authority devised in the interests of the river navigation, and not for drainage purposes. All they can promise is that, in carrying out navigation works, they will do so in such a manner as will best allow an outlet for the water in time of flood. The extent to which this will operate may be inferred from the use to be made of the £5000 per annum which the Conservators will receive from the three Companies connected with the Staines scheme, as soon as water is taken from the river under the powers of the Act. It is stated that the contribution, when received, will enable the Conservators to carry out additional works in the district of the upper navigation. There is abundant proof that were it not for the aid derived from the London Water Companies, the state of the river in respect to navigation and floods would suffer considerably, and future improvement would be seriously checked. The purification of the Upper Thames is a matter in which the funds provided by the Water Companies are very directly involved. The Conservators are diligently carrying into effect the powers obtained in their Act of 1894, which largely extended the area of their operations. Towns, villages, factories, farms, and private houses, are all brought under inspection in regard to their drainage; and in as many as 446 instances—presumably during the year—pollution has been diverted from the stream. There appears to have been no harm done by house-boats or launches; and certainly no case of pollution has been detected from this source. On the whole, the Conservators are able to claim that they have maintained the flow and purity of the river. They also show in their accounts that they have received £25,000 from the Water Companies during the past year with respect to the upper navigation; while less than £8000 came from other sources. For river purification, including the charge for office staff, outdoor staff, and analyst, the recorded expenditure is £2670. No doubt something may be added to this latter amount; but a review of all the facts respecting the Upper Thames shows that the Water Companies are the best friends of the river. If the Companies were extinguished, and their contributions withdrawn, it would go hard with the Conservators in respect to the river above London. Towards the receipts of the lower navigation, the Water Companies contribute only £2450, and the bulk of the revenue comes from the river traffic; the sum total being considerably larger than in the case of the upper navigation—the latter having especial relation to the water supply.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

MAY 5TH & 6TH, 1897.

Mr. CORBET WOODALL, M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

We conclude to-day our report of the proceedings at the above meeting by giving the remaining papers, with the discussions thereon.

THE CARBURATION OF COAL GAS.

By CHAS. E. BOTLEY and C. F. BOTLEY.

Introductory Remarks by Chas. E. Botley.

In the manufacture and distribution of gas at Hastings, the naphthalene difficulty had been a serious and annoying one for years; and on the author taking charge of the works in the spring of 1887, he found the condition of affairs in this respect totally beyond anything he had ever previously experienced or anticipated. On the works, the condenser was bye-passed, as it was quite blocked; the scrubbers were nearly so, and quite inefficient; and a Kirkham washer had the "bundles" all "made up" solid, so that the driving-shaft was bent, and it could not be worked—the inlet-main to the purifiers being also half filled up with tarry matter and black naphthalene.

On the district, complaints of stopped service-pipes from consumers were rife at all times; but in cases of sudden changes of temperature, the number became appalling. Complaints came in shoals—by post, telegraph, telephone, special messenger, and personally. Some of the letters received were of the most abusive description, charging the author with neglect of duty and personal responsibility for the trouble occasioned. One irate individual, who demanded a personal interview, then threatened to bring an action for damages sustained by the continual failure in his gas supply. Other consumers, who depended upon, or had adopted, gas for heating and cooking, were indignant when their supply failed at the moment of preparing to cook; for, as one consumer informed the author, "a hungry man is an angry man."

On these occasions, all the men in the fitting department, with a battery of force-pumps, were employed in rushing about the district, endeavouring to clear the services as fast as possible; but in many cases the ground had to be opened. Although no expense was spared, and immediate attention was paid to "short supplies" and "stops," many of the consumers objected to the continuous visits of the Company's men; and the risks to the Company were considerable. Our troubles in this respect culminated in a claim being made against the Company for £8000 as damages owing to a fire which occurred after a visit of the workmen for the purpose of blowing out a service-pipe, and which a Division of the High Court of Justice adjudged the Company responsible for; so that it can readily be imagined that naphthalene became the author's *bête noire*.

From the beginning, the author made strenuous efforts to combat this naphthalene difficulty. The works were first dealt with—the whole system of manufacture, from the retorts to the gasholders, being critically examined and studied, and records of temperature and conditions regularly kept; the condensing, washing and scrubbing, and purifying arrangements being entirely remodelled and reconstructed, with the result that, so far as the works are concerned, very little trouble was then, or is now, experienced. But the difficulties in distribution on the district still continued; and as the carbonizing results were improved, these troubles were much accentuated. All means at command on the works were tried for alleviating this. The usual coal used for many years has been New Pelton and Pelaw Main, with curly cannel for enriching. Increased quantities of cannel were used, supplemented also by about 20 per cent. of high-class Silkstone. The materials in the purifiers were also sprinkled with petroleum and naphtha; and attempts were made at desiccation. But all gave very little relief from the trouble.

On the district, benzol, petroleum, naphtha, and various other things were tried in the services after clearing them by pouring the liquid down or driving it in with the force-pump; but none of them proved effectual for any length of time, although the author noticed, from the reports made to him, that where petroleum was used, so long as any of it remained about the service-pipe stoppages were less frequent, or very much less difficult to deal with in removal. Attempts were made to get this effect on a larger scale, by employing petroleum in the mains. Trials were made in streets which were on an incline, and where stoppages were frequent. The petroleum was poured in slowly through a stand-pipe, so that it could trickle down the main, and, meeting the flow of gas, would be spread round the pipe. That this had some effect in dissolving naphthalene lying round the main was certain, from the deposits found afterwards in the syphons; but it appeared not to have affected the services where the greatest trouble had always existed. This application of petroleum, although somewhat expensive, was continued for a long time in various ways; the stand-pipes of the public lamps being utilized as a convenient way of getting it into the mains, besides keeping them clear.

When the author's son (Mr. C. F. Botley) joined him as his assistant in 1891, it was determined to go exhaustively into the whole subject of naphthalene deposition from the experience gained. The results of this investigation, which was continued over some years, and gradually developed, are related in the following portion of this paper. To Mr. C. F. Botley is due the credit of working out the details of the process now to be dealt with, which has insured that, so far as Hastings is concerned, the naphthalene difficulty is practically at an end.

The Carburation of Coal Gas.

To the treatment of coal gas with oil (hydrocarbon) by mechanical or physical means, the authors have applied the name of "carburation,"* in contradistinction to "carburetting," which, as now generally understood, refers to the enrichment of gas by means of oil rendered volatile by heat in some form. Carburation, so-called, is really a process primarily for the prevention of naphthalene deposits in the manufacture or distribution of gas, and is the outcome of a series of experiments carried out at the Hastings Gas-Works since December, 1893.

It is well known that naphthalene† is a hydrocarbon of the paraffin group, forming one of the illuminating constituents of coal gas, which has a most undesirable way of separating out from the gas and depositing (as light, pearly, crystalline scales) in all sorts of places. Why it does so, has been the puzzle of gas engineers and chemists for very many years. At Hastings, on the works, difficulties in the manufacture from this source have now been practically remedied. But in the town the trouble from it has been very great; and its behaviour has been most extraordinary. The annoyance and inconvenience to consumers, worry to the officials, the impoverishment of the illuminating power of the gas, the expense to the Company, and loss of custom, only gas engineers who have been troubled can fully appreciate. On the works, besides the coal used, the mode of carbonizing, condensation, purification, and storage, together with temperature, would appear to have bearing on its formation; but in the district, temperature and moisture are undoubtedly the main influences, although pressure and velocity may at times appear to affect the question. The most distinct cause is a sudden change in the temperature, such as in this country we are most liable to; and the former local practice of using salt water on the roads, of course, was inclined to add to the trouble. The extraordinary behaviour of the naphthalene has already been referred to. Of two houses side by side, connected up to the mains, and similar in every way, one will never be troubled; whereas with the other, it will be continually necessary to clear the service. In such cases as this typical one, it is vain to seek for a reasonable solution; and the only course seems to be to prevent, if possible, the deposition of this naphthalene in the distribution system. To this end the authors have directed their

* Derived from the Latin "carbo," through the French "carbure," the combination of some substance with carbon.

† $C_{10}H_8$, A.W. 128, melts at 80° C., boils at 217° C., but sublimes at a lower temperature; specific gravity, 1·1 to 1·2.

attention; it being apparent that, failing a mode of absolutely retaining or re-absorbing the naphthalene in the gas, a solvent process of combination of the two would be the best.

The knowledge that many liquid hydrocarbons—such as benzol, petroleum, &c.—dissolve naphthalene is fairly general. But it does not of necessity follow that for carburation the most solvent oil is the best; and after many laboratory investigations, it was decided to work on American lamp oil of 790 to 810 sp. gr., which is non-volatile at all ordinary temperatures in gas distribution. The oil having been decided upon, the next question was how best to introduce it into the gas so as to have the desired effect on the naphthalene deposits. The first experiment made, although on a small scale, was encouraging; and confirmed an important theory held as to the possibilities of carburation. The experiment was as follows: Gas registered by a small dry meter was passed very slowly upwards through a glass vessel filled with marbles, which were kept moist with oil delivered at the pressure of some 6-feet head from a very small tube (made by drawing down a larger glass tube) in the top of the vessel. The gas was then conveyed outside the laboratory, by means of india-rubber tube; and there passed through a series of six or eight glass tubes exposed to the weather, to either a msall gasholder or burner at will. In the last two or three tubes, naphthalene was placed. Careful measurements were taken of the oil passed through the "carburater," from the bottom of which a syphon drew off any surplus oil; and this was used over and over again. The apparatus was left in action for several days; and it was found that oil was suspended by the gas, and the naphthalene disappeared from the tubes, which were exposed to a temperature of 32° Fahr. and under most of the time. Indeed, moisture several times in the course of the experiment was frozen in the india-rubber tube.

Another laboratory experiment made in connection with this was to ascertain the effect of commercial petroleum on coal gas when left in contact with it. 820 sp. gr. oil reduced the volume of coal gas by absorption about 2 per cent.; but this same oil, after use in the carburater (described above), had very little effect on the volume.

Being satisfied with this result, it was next determined to carburate the gas used for lighting upon the works; and for this purpose a rough apparatus was made. It consisted of two zinc cylinders, 1 ft. 6 in. diameter by 2 ft. 9 in., joined by means of a small glass cylinder $3\frac{7}{8}$ inches in diameter, which enabled certain observations to be made. The gas to be treated passed from a meter into one cylinder by way of a $1\frac{1}{4}$-inch pipe; and out of the other, by a $1\frac{1}{2}$-inch pipe, to the works main. Drawing-off taps, pressure-gauges, and thermometers were provided on the cylinders. In the first instance, oil was injected in the form of spray from a fine orifice in the end of the inlet-cylinder, at a pressure of 15 to 20 lbs. per square inch; pressure being obtained by manual power from a Wells light cylinder. But the result was unsatisfactory. Very little carburation (oil suspended) was accomplished; and the necessity of having a very fine orifice, introduced the practical impossibility of keeping the same clear even by carefully straining the oil. Fine brass gauze was tried, instead of the orifice plate; but it was useless. The next step was to try the effect of injecting oil at a great velocity against a screen of brass wire gauze (150 meshes per inch), placed midway in the glass connecting cylinder. This enabled a large orifice for the oil to be used, and certainly had the effect of saturating the passing gas. The detrimental effect on the illuminating power of the same, however (which, owing to the prevailing low temperature at the time, was more marked than under normal conditions), brought only condemnation on the scheme of carburation; and the screen idea was abandoned. Having had steam put round the apparatus, to prevent the temperature going down too low, the first injection system described was reverted to and left in action.

Meanwhile, numerous other ideas were tried. Oxygen suggested itself as a possible carrier for the oil; and, with the co-operation of Brin's Oxygen Company, an experiment was made. The results, both as regards carburation and the illuminating power were disappointing, although the oxygen in the compressed form was convenient for any application.

The experiments were still continued as time permitted; and at last, from the accidental use of an oil syringe, the authors became acquainted with the basis on which present carburation is possible. It was noticed that an oil mist could be produced which was so light that it floated away in the air; and to produce this mist in a practical way, occupied attention for months. One or two of the experiments made in this direction may be of interest. A light wheel of tinned plate, about 8 inches in diameter, with quadrant pieces cut out, and the openings so formed covered with gauze and fitted with pieces like paddle floats on its periphery, was revolved rapidly by air pressure (still obtained from the Wells light cylinder); and against this oil was injected. This had the desired effect, but was very inefficient; and it will be readily understood that on a larger scale it would offer practical difficulties. An injector tar-burner was tried, using steam; but the heat in this case was undesirable, and dry steam could not be obtained, so that it was at the best unsatisfactory. A Wells light of new pattern under trial gave a further clue to the final solution; and an atomizer was made in a very crude form, which in time developed into the present efficient apparatus, which will be described in detail later on.

One of these atomizers was fixed on a large cylinder through which all the gas going into the district had to pass; and although great pains were taken to get some result, this was a failure—mainly owing to the fact that it was impossible to see inside the cylinder. For this experiment, pressure was obtained from a little pump made on the works, and fitted on the cylinder of one of the exhauster-engines; gas being compressed instead of air as in the earlier experiments. In connection with this, a reservoir (10 cubic feet normal capacity), fitted with blow-off, pressure-gauge, &c., was also provided in the engine-room, to assist in maintaining the supply. The small size of this pump, it was felt, was an impediment; and in July, 1894, a proper compressing-engine was ordered. While this was being made, the experimental apparatus was moved and connected up completely, to carburate more conveniently gas supplied for the works; any surplus passing into the town. Experience already gained proved useful now; and the exhaust steam from the new engine was used for keeping up the temperature of the carburater and apparatus, and also for a steam jacket round the pressure-pipe. It was late in the year 1894 that this apparatus, fitted with one atomizer, was put to work; and within a week, oil could be found in all burners in use throughout the works (area $6\frac{1}{2}$ acres), which result, of course, was most satisfactory. This gas being only for the works supply, was carburated to saturation point, which, on a larger scale, would be difficult and quite undesirable. The apparatus continued at work through the severe frost of February and March, 1895; and the freedom from stoppages was soon apparent and appreciated on the works. Many experiments were conducted while this was in operation; and general improvements were introduced. The Wells light bottom was fitted for a side gauge, so that the oil-level might be seen. A small exhauster driven by the compressing-engine was so fixed that the carburated gas might be passed into any gasholder, as desired.

The following method was continually made use of to prove the absorbing power of carburated gas: A glass tube, about 12 inches long and $\frac{3}{4}$ inch diameter, was provided with suitable brass fittings and taps at each end. Into this tube naphthalene formed under all conditions was introduced, and carburated gas allowed to pass through it into the air. The tube was, of course, exposed to out-of-door temperature; but it was always found that the naphthalene disappeared, although slowly. I have here a piece of pipe which was nearly blocked with powdered naphthalene when removed from a service in Hastings. It was put in the supply to a jet photometer on the outlet of the carburater—with result apparent. It was found most inconvenient to have to stop each time fresh oil had to be added; and to overcome this, a wrought-iron cylinder was made on the works, so that the oil could be added while the apparatus was at work—*i.e.*, under pressure. The charging cylinder in practice is fixed above the level of the main oil reservoir, and is provided with straining funnel and cock, pressure and blow-off cocks on the top, and an emptying cock at the bottom. The method of using this useful adjunct is as follows:—

With the funnel cock and blow-off cock open, the cylinder is filled with oil. Both these cocks are then

closed, and the pressure and emptying cocks opened. The pressure adjusts itself; and the cylinder empties itself under pressure by gravity, and slowly. But, of course, higher pressure can be used in the charging cylinder, if time is short. It will now be as well to describe the atomizer by which carburation is accomplished. It is constructed of brass fittings and brass and copper tube. There are three cocks; the top and front ones being for pressure, the lower and back ones for oil, and the end one for testing and clearing oil away. The main tube is screwed through a union for convenience of disconnecting; and for this same purpose, the pressure and oil cocks are provided with unions. The oil-pipe is of copper, with a small bore screwed at one end into the tee, and finished at the other with an orifice plate soldered on. The hole in this plate is about $\frac{1}{64}$ inch diameter. The tube is turned down, so as to leave a small annular space between its exterior and the bored interior of the brass pressure-tube, which starts from the second tee, and terminates slightly in advance of the oil-tube. The end of the pressure-tube is screwed for the nozzle-piece, which is a piece of small-bore copper tube shaped suitably at either end. The extreme end has attached to it the striking-plate; the best position of which is a factor in the efficiency of the apparatus. The striking-plate was originally made with only one central hole; but this has been abandoned in favour of five small holes bored to a needle gauge. The action of this atomizer is briefly as follows:—

Oil is forced through the orifice plate with considerable velocity on to the striking-plate, where the pressure that meets it completes its division into very fine oil mist. One of these atomizers will carburate to saturation-point, under maximum velocity in gas distribution, about 4000 cubic feet per hour, and will work without attention for any reasonable period, so long as a pressure and a supply of oil are maintained. There are, of course, some gummy oils which would not allow the atomizers to be worked efficiently for long together. The experimental apparatus remained in use only until the spring of the year 1895, when, all signs of naphthalene having disappeared from the works mains, it was stopped.

Careful records of the working were kept; but it is preferred not to give these, as data relating to more extended experience are now available. This experimental apparatus enabled the following points to be noted:—

1.—Carburation is more easily carried out in cold weather. The main reason of this is doubtless that the specific gravity of the gas is then lower.

2.—The degree of carburation (or oil saturation) varies with the temperature, the velocity of the gas through the carburater, the efficiency of the atomizer, and the specific gravity of the oil used. The degree of carburation can be judged by the colour; even half saturated gas being easily visible, and like smoke or steam.

3.—Carburated gas is permanent under ordinary conditions, and will pass through water without alteration. This is probably a clue to its powerful effect on naphthalene, in the formation of which moisture (as already stated) is an important agent. Carburated gas will not apparently carry moisture, any more than oil-sheets will absorb water. Permanent oil gas will have moisture in suspension, which may account for some disappointing effects in regard to naphthalene experienced by some in recent years. The permanency of carburated gas is to some extent destroyed by abnormal friction, such as in governor-burners. When working with *saturated* gas on the works, it has been no unusual thing to have to empty the oil out of Peebles governor-burners twice in a night. Even when governors contained oil thus deposited, the gas could be seen issuing from the tip in the form of mist.

4.—Carburation for naphthalene, properly carried out, has little or no practical effect on the illuminating power of the gas. Many tests were made to establish this fact. It must be quite understood, however, that imperfect carburation with some oils would have a tendency to impoverish the coal gas. Carburation for enrichment was tried; and the gas on the works was kept between 17½ and 18 candles for a week without difficulty. As to cost, &c., it is not advisable to here state. Of course, different oil is used for this purpose; 90 per cent. of 680-700 sp. gr. benzol, canneline, and light petroleum being tried.

5.—The atomizer should be worked at uniform pressure as regards oil and pressure. The pressure with different oils, to be most efficient, appears to vary somewhat; and with the type of atomizer described

Pounds per Square Inch.	Sp. Gr.
15 to 20, with	600 oil.
20 „ 25, „	700 „
25 „ 35, „	800 „

would appear to be about right. It was at first thought that there should be a difference between the relative pressures; but a very little consideration will show that this cannot be so. If the oil pressure is the higher, the oil will be forced down the pressure-pipe; and should the pressure (compressed gas) be the higher, the oil supply would be stopped or certainly retarded. Pressure is kept as low as possible on the ground of expediency, as oil under heavy pressure is difficult to deal with—causing leaky joints. The pressure should be maintained steadily, but may vary over considerable limits without greatly affecting the working of the atomizer. The strokes of the compressing-engine produced bumping in the oil reservoirs; and, as this stirred up the oil, it was most undesirable. This has since been overcome, as will be explained.

6.—The oil must be clean; and, to ensure this, it is carefully strained through very fine gauze, which, it may be noted, will not pass water after having been used for oils. Fibrous material is of more impediment than ordinary grit.

7.—Temperature at which carburation is conducted is a matter of importance, and is controlled by the atmospheric temperature. A degree or two above that of the gas in the mains is the most satisfactory, in the authors' opinion.

8.—A remarkable fact was observed in the experimental carburater. It was this: The drip liquid was often more, or as much as, the oil used by the atomizer; and on inquiry into this, it was discovered that much water had been deposited, which, of course, separated out from the drip oil on being allowed to stand. Whether this was due to peculiar conditions of temperature in the zinc carburater, or that the gas had greater affinity for the oil than the water, the authors have not been able to so far satisfy themselves.

9.—The point as to increase in volume due to the added mist has been raised with the authors; but the question is one of small importance, and if any increase of volume really does occur—as is possible—it is of no practical account in ordinary carburation. Of course, with some enriching oils, in summer, there is an undoubted increase in bulk.

10.—Carburation is only, of course, considered as practicable on moving gas—*i.e.*, the supply to the town.

In July, 1895, trouble with naphthalene still being considerable, arrangements were made to put down apparatus for carburating the whole of the gas supplied to Hastings and St. Leonards—about 360 million cubic feet per annum—with a remarkably good load curve. The arrangement now to be described must not be taken as an ideal one, especially as regards the mains; but it was extremely difficult to find a site—space being limited, and the action of the governors being undesirable on the carburated gas. The Hastings Gas-Works have been remodelled, with a view to future extensions; there being two 18-inch mains and one 24-inch between the valve and governor rooms. The governors, of which there are three, are so arranged that any governor can be used to supply any one or both town mains. At present, gas is distributed from the works by means of two mains, 24 and 12 inches in diameter respectively; but a third one 18 inches in diameter is prepared for extension. Hence the three governors.

The site for the carburater finally decided upon is in front of the valve-room, and between the engine-room and blacksmiths' shop, and is unavoidably in a very cramped position. Here the 24-inch main was cut asunder; and a 24-inch bye-pass or shunt main put in. On this bye-pass, a Cowan's governor (rendered necessary by the other three being out of action) and the carburater are worked; there being inlet, outlet, and bye-pass valves. The whole apparatus is accommodated in a small brick building measuring 11 ft. 6 in. by 21 ft. 6 in. outside, and roofed with slate. It is immediately above the two mains previously referred to, which connect the valve and governor rooms. The concrete foundations are carried down below the level of these. The earth excavated within the area of the building was not replaced; the concrete foundation being rendered with cement inside, to form a cellar under the working iron-plate floor of the building. The floor is

some 2 feet above the outside ground level. The 24-inch main passes, by means of an arch, through the foundation of the compressor. The apparatus seen on the working floor consists of the following parts, described later in detail: (1) The carburater proper. (2) The governor on inlet. (3) The compressor. (4) Pressure reservoir. (5) Oil reservoirs. (6) Oil charging cylinders.

(1) The carburater is a welded steel pipe, 24 inches in diameter and 13 feet long, made by Messrs. Piggott and Co., of Birmingham; and 24-inch branches, 10-feet centres, are riveted on one side for inlet and outlet. The ends are finished with angle-iron flanges and covers of ¼-inch steel bolted. In this plate, at the inlet-end, the thirteen atomizers are fixed. Six of these is the maximum number required at any one time for ordinary carburation; the spare ones being originally provided in case of repairs, and as giving greater choice of position. The margin, however, has been found in actual practice to be larger than is really required.* The main oil supply for the atomizers is brought along the floor from the oil reservoir to under the end of the carburater by means of a 1-inch (steam) iron pipe, into the top of which the ⅜-inch gun-metal union cocks are tapped and soldered; the oil-pipes of ⅜-inch brass rising vertically to the atomizers.

The main pressure supply-pipe is also of 1-inch iron from the pressure reservoir to the top of the carburater. The ⅜-inch pressure-cocks, like the oil-cocks, are of gun-metal, screwed and soldered horizontally into the iron pipe. The two unions on the cocks, together with the union on the atomizer body as already described, enable any atomizer to be removed in a very short time. A spare cap is kept on a dead boss on the plate to be screwed on where an atomizer is to be removed. In the other end plate of the carburater, a sight-glass is provided, together with various size connections, in case they are required for experiments, &c., at any time.

On the under side of the carburater, rather more than half-way towards the outlet end, another 24-inch branch is riveted on, and finished with a flange and ¼-inch steel plate, bolted on like the others. This is termed the drip well,† and is to collect the atomized oil or the drip from the nozzles of the atomizers, which it is difficult to avoid in actual working. It extends 3 ft. 6 in. vertically from the centre of the carburater, and will hold about 40 gallons (1·6 per inch). A ½-inch pipe, controlled by a cock, conducts the oil by gravity‡ from the drip well into a small lifting and straining cylinder fixed in the cellar, and described later on. The level of the oil in the drip well is shown by a gauge fixed on the side; and this can be measured from the floor. On the top of the carburater a test glass (with thermometer) and cocks for testing are fixed. Three sight-holes on riveted branches, 6 inches diameter, are provided on the side of the carburater—one opposite the inlet and two on opposite sides about half-way along. The 6-inch sight-glasses, of ¼-inch plate, 7 inches diameter over all, are fixed in cast-iron flanges, 1¼ inches thick, faced on the edge and one side, and recessed $\frac{5}{16}$ inch deep on the inside for glasses on the end of the branches. The sight-glass in the end plate is fixed by means of a 1¼ inch by ¼ inch steel annular ring, ½-inch set-screws, and special cement, in a cast-iron recessed boss riveted to the plate. These are essential to proper carburation; enabling the working of the atomizers, &c., to be seen with the aid of artificial light of some kind. In case of any accident to the glasses, blank flanges of sheet iron are kept ready, but have never been found necessary. The difficulty in keeping the flange and recessed sight-glass joints oil-tight would have been very great, as in the experimental carburater, but for the special cement used (a mixture of plaster of paris and glue), which will resist oil at all ordinary temperatures. It must be made in small quantities, and used quickly.

The inlet to the carburater from the governor is by means of a 24-inch double bend cast-iron flange connection, having a sight-hole at the top bend (to view atomizers), and a drain pipe at the lower bend. Similarly, the outlet to the town main is by a 24-inch cast-iron connection of special design, forming a syphon or trap for surplus oil. A ½-inch pipe-drain, with cock, is provided from this trap to the small cylinder in the cellar. A dial thermometer is also fixed on the inlet just above the floor, and has to be watched carefully. The general temperature recorded here is the same as the water-outlet, or slightly under the temperature of the station meter outlet. Like the inlet, it is fitted with a sight-hole protected by a wooden cover. This enables the carburated gas to be seen; and the appearance of the same as viewed here is like exhaust steam. On both inlet and outlet joints of the carburater diaphragms of zinc about 23½ inches in diameter are fixed between steel and cast-iron flanges, for the purpose of preventing excess oil getting forward. It may be here noted that the friction or resistance formed by these diaphragms projecting about ¼ inch all round inside the joint, is about the only thing we found to separate the oil from the carburated gas. The mean velocity of the gas through the carburater is about 3·5 feet per second, with a minimum velocity of 1 foot per second and a maximum of at least 17·5 feet.

(2) The governor for the 24-inch main is of Cowan's make, with water loading, for which a cistern is fixed up in one corner of the building close to the governor.

(3) The compressor and engine, which has done excellent work, was made by Messrs. Pope and Sons, of Slough, who have had much experience in such work.* It is fixed at one end of the building, extending the whole width. The compressing cylinder necessitates a constant water supply in the circulating jacket. The waste (warm) water is run to a trap in the cellar direct, or through the condenser hereafter mentioned; and is set to run at a constant rate. The compressor is fitted with a relief-valve, for ease of starting; and the compressed gas is conducted by a copper pipe to the reservoir. The ¾-inch gas suction for the compressing cylinder is so connected that either ordinary (from before the governor) or carburated gas (from the outlet) can be used. It may be noted that the compression of carburated gas has the effect of separating all the oil from same. Carburated gas is only, therefore, occasionally used for lubricating valves, &c., of the compressor.

With reference to the (purified) gas used for compressing to give a supply of pressure, this is a very variable quantity—depending upon the working pressure, density, description of oil, &c. But under normal working conditions, it is calculated that, at 75 lbs. per square inch (25 lbs. on atomizers), the pump compresses 1 cubic foot per 9 to 10 revolutions, and each atomizer uses 60 cubic feet per hour. Thus, with four atomizers in efficient use, the engine runs 36 to 40 revolutions per minute to maintain the pressure at 75 lbs. per square inch.

A 24-inch gauge on the wall near the engine shows the suction of the pump. This same gauge is also so connected that it may be used for testing reducing-valves on the pressure system of pipes. In summer-time, the fly-wheel of the compressor is made use of for driving a fan fixed above to keep the air in the building circulated, and thus assist to keep down the temperature.

(4) The high-pressure cylinder (tested to 200 lbs. per square inch capacity, 10 cubic feet normal capacity) is fixed by brackets on the wall parallel with the carburater. The pressure in the cylinder is shown by a gauge on the wall above the engine, and is usually maintained at 75 lbs. The 1-inch outlet to the atomizers is through a reducing-valve, which keeps the pressure steady by reducing it by from 50 lbs. to 25 lbs.; the bumping by the strokes of the pump thus being avoided. The reduced or working pressure is shown by a gauge taken off the oil supply-pipe to the charging reservoir, and is fixed so as to be readily observed. A safety-valve, set at 100 lbs., is fixed on the reservoir; and if it blows off, the gas is conducted back into the inlet of the carburater. A bye-pass or shunt to this safety-valve enables the reservoir to be emptied of pressure, or gives a supply at higher pressure for charging the oil reservoir quickly, as will be again referred to. In the compression of ordinary gas, a deposit of a disagreeable oily liquid (or, in the case of carburated gas, oil only) occurs in the pressure reservoir; and means have to be taken to remove it. This is done by inserting a ⅜-inch brass pipe through one of the bosses on the top of the cylinder to seal in liquid at the bottom of same. The out-

* In carburation for enrichment, as many as ten have, however, been used.

† An atomizer was made and used which practically had no drip; but it was more complicated, and so more likely to get out of order.

‡ The average specific gravity of the drip-well oil at 60° is ·825, independent to a great extent of its original gravity.

* Steam cylinder, 6½ inches diameter, 12-inch stroke; pump, double-acting, 4 inches diameter, 12-inch stroke, to deliver about 600 cubic feet per hour at a pressure of 150 lbs. per square inch.

let is controlled by a cock, and brought within 12 inches of the floor level. It will be readily understood that, on opening the cock on this pipe, the pressure in the cylinder forces the liquid out.

(5) The main oil reservoir is of welded steel, 60 inches by 20 inches inside, with a working capacity of about 50 gallons, stood upon end in a catch tray of galvanized iron, placed direct on the iron plate floor. The pressure supply enters the top; and the oil leaves at the bottom on the side about 4 inches up. The front side of the reservoir is fitted with Dewrance's patent water-gauge. The top fitting of the gauge has a side union tap, to which the oil-pipe ($\frac{1}{2}$ inch copper) from the charging cylinder is connected; and another $\frac{1}{2}$-inch union cock serves as a blow-off or means of connection if wanted. For ordinary carburation, the oil used per hour varies, of course, with the number of atomizers in use, and with the density at which these are worked. The maximum per atomizer per hour may be taken at 0·5 gallon; and the minimum, at 0·10 gallon. Of course, it must be remembered that all this is not suspended; from 40 to 50 per cent. roughly, according to density, being recovered and used again, so long as the specific gravity at 60° is under 840.

(6) The oil-charging cylinder is of riveted steel, and was made on the works. Its capacity is about 10 gallons; and it is fixed in a catch-tray carried by brackets on the wall opposite the pressure reservoir, and above the level of the oil reservoir. The principle of charging under pressure has already been described. This cylinder is charged through a straining funnel from either of three sources—viz., from the store-tank by gravity, from drums outside the building by pressure, and from a small cylinder in the cellar, also by pressure. The supply of ordinary pressure to the charging reservoirs, &c., is taken from a T-piece in the main supply. The shunt or higher pressure is similarly connected; and a cross connection with the valve between the two iron pipes, enables the pressure reservoir to be emptied, as already explained. In case it is desired to use light spirit in summer time, it is brought alongside the building in drums, and connected up in the usual way. But the funnel on the charging cylinder is fitted with a lute outside rim; and a box-cover having a sight-glass and inlet-tube is sealed in mercury. The bib-cock on the delivery-tube from outside drum is connected by a piece of india-rubber tube to a connection on the sealed lid; and thus vapour is prevented from collecting in the building. The outlet of the charging cylinder to the oil reservoir is by way of a $\frac{1}{2}$-inch union cock at the bottom. The time occupied in putting in a 10-gallon charge by the ordinary gravity method is 15 to 20 minutes without attention; but the whole operation can be readily done in four or five minutes if desired, by using higher pressure through the shunt main from the pressure reservoir—although, in this case, the man must be present to regulate the pressure, so that it does not exceed 50 lbs. on the atomizer during the charging.

The small cylinder (similar in make to the charging cylinder, but of 6 gallons capacity), fixed with its catch-tray, &c., in the cellar, receives the oil from the drip-well and outlet syphon, and raises same through a $\frac{3}{8}$-inch brass tube, by aid of pressure, to the top cylinder. The cocks for these cylinders are arranged as near as possible together, for ease in manipulation. The compressed gas used in the charging is not wasted, but returned by a special blow-off pipe of $\frac{3}{8}$-inch brass to the outlet of the carburater; the vents on the cylinders only being opened a moment or two each charge to restore atmospheric pressure. All these oil-charging connections are shown in the diagram accompanying this paper.

Three 18-inch pressure-gauges are fixed, and register respectively the inlet to the governor, and the inlet and outlet carburater pressures. Connections are made for jet photometers (fixed in the exhauster-room), on the inlet of the carburater either before or after the governor, and on the outlet. These are of use in watching the relative illuminating powers, and as a general rule register alike; but, of course, there is a marked increase shown by the outlet jet when some oils—such as benzol—are used. The photometer in the laboratory can also be connected to the inlet or outlet of the carburater for testing purposes.

Oil has been supplied in barrels (petroleum) and steel drums (special inflammable oils); but recently a storage-tank of 3000 gallons capacity has been made use of. From the siding—accessible by either railway or road tank-waggons—a filling-pipe ($1\frac{1}{4}$-in. Perkins tube), with hydrant and cock, has been laid; and the outlet to the carburater-house is of $\frac{7}{8}$-inch Perkins pipe, with a cock at each end. This pipe, being in the gas-main trenches, is exposed to view nearly the whole way, so as to trace leaks readily. By this means, and that of emptying the steel drums under pressure, it will be understood all handling of oil is reduced to a minimum, with consequent saving of labour, waste, &c. The storage-tank is below the level of the siding and above that of the carburater-house, and so it is filled and emptied by gravity. The building is lighted electrically; the current being obtained from our own installation.

The carburation plant at Hastings, as viewed by this Institution last May, has been entirely carried out by the works department of the Company, and has cost, including experiments, between £500 and £600. It may, to some, appear to be unnecessarily elaborate; but it should be remembered that this is the pioneer and original plant. Nothing of a like kind, so far as the authors can ascertain, has been tried before; and every detail has had to be carefully considered.

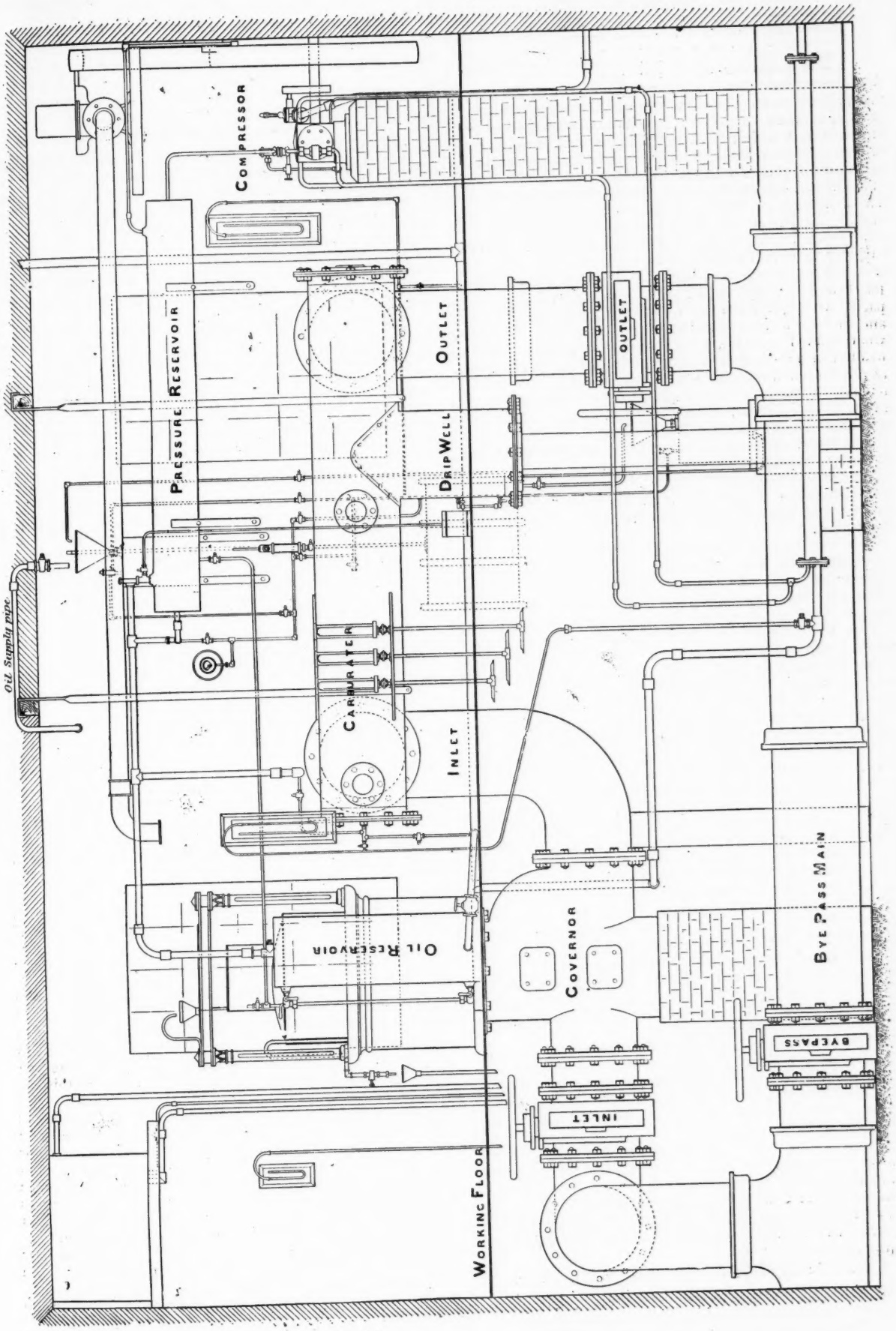
It will now be understood that the whole process has been worked out from two axioms so to speak: First, naphthalene will not crystallize (form) in the presence of certain hydrocarbons. Secondly, gas is known to carry quantities of aqueous vapour in suspension; therefore it should carry oil vapour. The authors have endeavoured to make the record as full as possible, although it but inadequately conveys an idea of the labour involved.

The actual working of the carburater is very simple. The pressure is maintained as constant as possible; and atomizers put on or taken off according to the flow of gas—an indication of which can be obtained by noting the sound of the carburater.

To be efficient, the atomizers must be worked at the proper density, and produce oil mist, not oil rain. The drip from the atomizers has already been referred to. This can be reduced to practically nothing, if the atomizers are worked light; but it will be generally found more convenient to allow a slight drip, instead of excessive attention. The degree of carburation can be judged by a practised eye at a test-cock, by the cloudiness or fog at the sight-glasses; or by the slate test. This last is very reliable, and depends on the fact that oil produces a permanent (at least, for a time) grease spot on clean slate; whereas water vapour immediately evaporates. A very good idea of the saturation or degree of carburation can be obtained, by noting the time required to produce the spot on slate, when the gas from a small test-tube ($\frac{3}{8}$-inch brass) is allowed to play against it. At Hastings, two such test-cocks are used; one already mentioned on the carburater, and one taken off the 24-inch main at the back of the governor-room. To put an atomizer to work, it is only necessary to open two cocks; the oil being turned on first and viewed from the sight-hole. The quantity is regulated by the cock according to the density at which it is desired to work; and then the pressure-cock is opened, until the solid jets of oil as issuing from the nozzle are completely turned to mist. The engine speed is, of course, regulated according to the atomizers in use; and the engine can be stopped if necessary for oiling, &c., for a short time without greatly affecting the working of the carburater. The oil is put in during the day, and a charge left ready in the charging cylinder, in case it is wanted during the night.

Turning now to the working observations and the results of this process, which has been patented by the authors (No. 9316 of 1896, see Appendix). The apparatus was put to work on Nov. 19, 1895, and has remained in operation ever since. In the January following, the beneficial effect commenced to be apparent; and it has ever since held naphthalene in check, and relieved the officers of the Company of all anxiety on that score. The maximum number of complaints registered in one day since the process was started has been 21; whereas previously it was 229.

The public lamps were the first to feel the beneficial effect of the oil, and for some time caused a little trouble, until the process had been worked long enough. The explanation of this is that, in the first instance, partly dissolved naphthalene was carried up in mechanical suspension to the floats of the lamp-governors; and being too heavy caused small lights, and sometimes lights out. In other cases, especially in very cold weather, the lamp-governors filled with oil; and on decrease of pressure at


Compressor
Pressure Reservoir
Outlet
Drip Well
Outlet
Carburater
Inlet
Oil Supply pipe
Oil Reservoir
Governor
Bye Pass Main
Bypass
Inlet
Working Floor

11 p.m. went out. These were, of course, only trivial difficulties, as compared with the ultimate benefits received.

Oils of several kinds have been tried, viz.—

Tea rose American lamp oil	·790 to ·810
Light and super canneline	·700
Carburine	·680
Coal tar naphtha	·890 to ·925
Refined Russian petroleum	·825

And the authors' theories and conclusions from the experiments made were proved in a remarkable way. It may be at first difficult to follow; but it has nevertheless been found to be a fact at Hastings that the best enriching and solvent oils are not the best for naphthalene prevention or carburation, properly so called. This is probably due to the different vapour-tensions produced; and it has been noted that gas carburated with petroleum absorbs naphthalene far better than that treated with light spirit or even benzol. A parallel fact which has been observed has only to be called attention to, to confirm this. Systems of enriching by means of light spirit have not always been found to give a permanent relief from naphthalene stoppages, as might have been expected; whereas the start and operation of carburetted water-gas plants, especially when refined petroleum has been used, have speedily resulted in a reduction of complaints. That even oil gas cannot be relied upon as a permanent naphthalene cure is evident, for recently there came under the authors' notice a case from Scotland, where the use of oil gas had actually produced this gas manager's nuisance.

The street syphons have been carefully noticed; and, generally speaking, the quantities of water have been about the same in addition to small quantities of deposited dark green or nearly black oil of about ·900 specific gravity, and containing up to 6 per cent. of naphthalene in solution.

That the process does work better in winter (when the temperature is low and the flow of gas greater) than summer, there is no doubt. For the winter months of 1896, complaints averaged 3·96 per day; and in the warmer months, 5·16 per day. Indeed, last summer—which, it will be remembered, was very hot—the process caused the designers some anxiety. But a clue to its somewhat ineffectiveness was found, and explained a good deal. Some carburetting benzol was tried, and gummed up the atomizers; and for some time they were allowed to "rain" rather than "mist;" and the carburation in consequence was not permanent—the oil being deposited in the 24-inch main between the carburater and the governor-room. At all times, however, this main has proved a useful fixer; preventing over-saturated gas passing into the town at hours of low consumption. The very hot and dry weather, too, caused the naphthalene remaining undissolved in the mains to be dried, and so float in the stream of gas finally lodging in the services. This only resulted in complaints of diminished supply; and although all these are registered as stoppages, it is only fair to say that whereas "No gas" was generally the case, it is now hardly ever recorded as a complaint. The process has resulted in no difficulties with consumers, although oil has frequently been found in internal fittings, and in some cases taps have got a little loose and have had to be tightened. In the opinion of a leading meter-maker, the carburated gas is good for meters; and it certainly tends to keep them, and the internal fittings in good order.

Copies of a daily record sheet for winter and summer are included in the Appendix, as well as a yearly summary of stoppages to April 25 this year. The total oil of all kinds used last year was 8000 gallons (equal to 0·022 gallon per 1000 cubic feet of gas), of which 6000 gallons were actually suspended (equal to 0·017 gallon per 1000 cubic feet of gas). Oil recovered (this includes all oil deposited within the area of the works), when over 840 sp. gr., is allowed for at 3d. per gallon; being used for many purposes—such as lubrication, cleaning, and even carburetting. The cost for the year, including interest, steam, attendance, oil, &c., was 0·24d. per 1000 cubic feet of gas *sold*, as per statement following:—

Carburation Account for 1896, *Hastings Gas-Works.*

Oil received, 8109 gallons.			
Cost	£280	17	3
Average cost per gallon	0	0	8½
Oil used, 8000 gallons.			
Cost at 8½d.	£277	15	7
Less 2000 gallons at 3d.	25	0	0
Net cost	£252	15	7

Gas sold, 348 771,000 cubic feet.

Cost of Working.

		Per 1000 Cub. Ft. Sold.
Oil	£252 15 7	0·173d.
Other charges, including interest, repairs and labour, &c.	95 19 10	0·067
	£348 15 5	0·240d.

Oil used per 1000 cubic feet sold	0·022 gallon.
Oil suspended	0·017 ,,

75 per cent. of oil used was suspended.

To this point, this paper, it should be remembered, was written during November and December, 1896; but the theories of carburation are founded on experience up to a more recent date. In the authors' opinion, gas must be "humed" with oil to be appreciably effective with naphthalene. Carburated gas, of course, fulfils this condition entirely; the oil in mechanical suspension apparently preventing naphthalene crystallizing out from the gas, while existing deposits are dispersed by absorption, and in a limited degree by solution.

It will be seen that carburation oils are non-volatile at ordinary temperatures, and would appear to raise the vapour-tension sufficiently to retain naphthalene. On this important point, a recent experience may be interesting. A carburater is now in use at Hastings on the inlet to the condenser, with the two-fold purpose of self-enrichment and keeping the condenser clear of heavy deposition. This enables the condenser to be worked at a higher temperature than formerly, and assists the illuminating power somewhat; owing mainly to the retention of the naphthalene. But the town carburater apparently must be kept at work, to ensure the permanent suspension of the naphthalene. For the purposes of this paper, for the week ending March 16, 1897 (see Appendix) a light grade oil was used in the town carburater; and the immediate consequence of it was the finding of naphthalene in the plugs of several street-lamp cocks close to the works, for which neither temperature nor other condition appeared to account. The light grade oil was discontinued; and no more trouble has been experienced. This experience is additional proof of the importance of the point in question. The exclusion of aqueous vapour from carburated gas, would also appear to assist its action, and is important in relation to severe weather—as in February, 1895. Water is still found in the street syphons; and services are sometimes partly stopped from some cause. But these would seem to be due to percolation, rather than to deposition from the gas. It is expected that the amount of such deposits will gradually decrease, as carburated gas undoubtedly tends to decrease leaks; the oil deposited by friction finding its way into all spaces, and preventing either gas escaping or water entering. In the Hastings town carburater, many screwed joints can be seen slightly leaky to oil, but without any escape of gas. It will probably be some years before any effect on the leakage account at Hastings—which is under 4 per cent.—can be traced, due to this property of carburated gas.

Anticipating inquiries as to the use of carburetted water gas at Hastings in relation to the prevention of naphthalene, it must be understood that only trials of the plant were made at the end of last year, so they cannot have had any possible influence. This year, to date, as will be seen by the summary, has been a remarkable one in regard to stoppages. But the authors cannot see there has been directly anything due to the use of water gas in this connection; for at Hastings, under present conditions of manufacture, the water gas is bound to be of a permanent character, and has not exceeded 20 per cent. of the daily make. It has also been used in the hours of daylight principally. Indirectly, however, the water gas has undoubtedly assisted carburation, in this way: The specific gravity of Hastings coal gas may be taken at ·455, whereas the mixed gases reach at least ·490 in density, which obviously gives greater opportunities for carburation.

In connection with the theories of carburation now advanced, some French patents, which have only quite recently come under the authors' notice and investigation, are interesting; and translations of them are given in the Appendix.

The summary of this (1897) year's working to date is also given in the Appendix; and it will be noted that the influence of cold is very marked, and that the quantity of oil suspended is obviously too small to interfere with combustion.

Appendix.

I.—Description of 1889 French Patent (No. 201,578) of M. Schneckenburger.

A Method of Clearing Gas-Pipes and Services Blocked by Naphthalene.

For removing naphthalene from gas-pipes, I propose to dissolve it, and recover the solution in the syphons of the system. This is the principle of the method which is essentially the object of my invention.

I use as solvent a hydrocarbon capable of conversion into a gaseous state or vapour, such as petroleum, benzene, &c. This vapour or gas is introduced into the pipes by the branches or by the public lamp-posts.

The temperature of the oil should be above the melting-point or running state of naphthalene, but under that which would by its degree or intensity cause damage to the pipes or fittings. With reference to the pressure of the dissolvent liquid, it must be kept sufficiently moderate in the case of a gas-main in use, so that burners or engines are not unduly interfered with.

The naphthalene dissolved by contact with the gas or hydrocarbon vapours is kept in that state of solution in the syphons connected with the gas-mains, and the liquid is removed by means of a pump or otherwise.

I consider in certain cases, when deposits of naphthalene are not very dense, it suffices to heat the gas itself for some time in order to clear and remove the incrustations in the pipes.

In conclusion, I claim as my invention my method of removing naphthalene from gas-pipes without opening trenches or detriment to the pipes by openings, essentially by using a hydrocarbon, in a state of gas or vapour, acting as solvent of naphthalene under the conditions of temperature and pressure already described. I would point out the work of removing incrustations should be carried out while the pipes are charged.

II.—Description of 1890 French Patent (No. 209,090) of M. Schneckenburger.

A Process for Clearing Gas-Pipes Blocked by Naphthalene or like Hydrocarbons; Utilizing the Same for Increasing the Illuminating Power of the Gas.

For clearing or dispersing obstructions formed in the gas-pipes by naphthalene and the like, I propose to melt, dissolve, or convert these bodies into a combustible, volatile substance, and, at the ordinary temperature of working, clearing these away in the circulation of the gas, and carburetting the same.

I use as solvent a hydrocarbon, such as petroleum, methylene, benzene, and the like—bodies known necessary to prevent, by their presence in the gas, the deposits of naphthalene or the like. These bodies are introduced in the pipes by the branches, lamp-posts, taps, syphons, &c.—in a word, by every opening available in communication with the same where the points are obstructed—in the state of gas, vapour, &c. (that is to say, in a state of extreme division), in order to make it remain in suspension in the gas, and cause it to thus penetrate more or less throughout the recesses of the pipes or their parts. These bodies are at any temperature at the moment of their injection, but under that which would cause by its degree damage to the pipes or connections.

On the contact of one or more of these hydrocarbons introduced simultaneously or successively, naphthalene melts, is dissolved and carried away in suspension by the gas in the state of vapour, or is converted into a semi-dissolved mass, very much more volatile than naphthalene which the gas slowly sweeps away (absorbs), so carburetting itself. These actions, which go on separately or simultaneously, depend on the temperature of the vapour where introduced into the gas, and the respective quantities of the naphthalene deposits and the hydrocarbons employed to disperse them.

In the condition of melting or of complete solution, naphthalene flows, and is recovered in the syphons. If the removal of the naphthalene is incomplete, or some remains, the temperature of the hydrocarbons should be raised when the naphthalene is carried away by the gas right to the burners, where it is consumed with the gas.

To convert the oils to the state of division described above, I employ heaters of all kinds, tubular boilers, &c., instantaneous evaporators, &c., heated in any way by coke, gas, &c., essential to splitting up the liquid hydrocarbons.

I claim as my invention my method of clearing obstructions (caused by naphthalene and the like, all being utilized as combustibles, and without injury to the pipes) by the apertures, without opening trenches to find the pipes. I say the process has to be applied while the pipes are charged with gas. I claim equally as my invention the application to the clearance of gas-pipes by steam-heaters as by the generators for vaporization described.

III.—Provisional Specification of C. E. & C. F. Botley.*

Improvements in and Relating to the Treatment of Gas for Illuminating and other Purposes.

We, Charles Edward Botley and Charles Frederick Botley, junior, both of "Guildables," Wellington Road, Hastings, in the county of Sussex, England, Civil Engineers, do hereby declare the nature of this invention to be as follows:—

This invention relates to the treatment of gas, either in the process of manufacture or in the distribution of same, whereby naphthalene and like deposits are prevented, and the illuminating power of the gas can be increased.

We are aware that volatilized hydrocarbons have been mixed with gas to prevent naphthalene deposits, and for increasing the illuminating power of the gas; but the process has proved ineffectual in so far as preventing the naphthalene deposits, as hydrocarbon in this condition has very slow action on naphthalene, and moreover carries moisture, which is an accepted cause of the deposits.

Now, according to our invention, we overcome this disadvantage by the production of an oil or hydrocarbon mist, of suitable specific gravity, within a vessel through which the gas to be carburated is constantly passed, so that the mist or hydrocarbon particles can be taken up by the gas in proportion to its specific gravity, and thereby prevent the formation of any deposits, as the action of the hydrocarbon produced in this manner absorbs or dissolves the naphthalene or like deposits.

This we effect by passing the gas to be treated through a vessel at one end of which are atomizers for producing in the form of mist any suitable oil light enough to be suspended by the gas, such as from ·650 to ·980 specific gravity. The said atomizer may be operated by either compressed air, gas, or superheated steam, and is constructed so that the hydrocarbon material and the supply of pressure can be proportionately regulated.

They each consist of a tubular body provided with suitable inlet branches, one of which communicates with a smaller tube arranged within the said body to convey the oil, while the other communicates with the annular space between said tube and the body, and forms a passage way for the supply of pressure. The combined oil and pressure then enter an expansion chamber, and finally pass through a nozzle carrying a striking plate to complete the atomization of the liquid.

Dated the 28th day of April, 1896.

[For Appendices IV. to VIII., see pp. 1116, 1117]

Discussion.

Mr. J. W. Helps (Croydon) said the subject that Messrs. Botley had brought forward that day was unfortunately one of standing interest to all gas managers; and they must be heartily congratulated on the vast amount of labour they had undertaken in the preparation of their paper. The details given would enable most of them, after a few weeks' hard labour, to so thoroughly understand the apparatus as to be able to make it themselves. There was an old saying that "The proof of the pudding is in the eating;" and that might be safely applied to this paper. In fact, this was the basis on which Mr. Botley had gone in deciding on the success of the experiment at Hastings. At the same time, he could not help thinking that it was somewhat unfortunate that the weather during the last two years had been so mild that it had scarcely given him (Mr. Botley) a chance of seeing whether the apparatus would work under all conditions. He had taken out a number of figures relating to the stoppages that had occurred in Croydon—a town which might be fairly compared with Hastings, although somewhat larger, inasmuch as the coal used was very similar (Newcastle), and the illuminating power was some 15 or 16 candles. Taking the four months ending in April, 1896 and 1897, he found that in 1896, in the 120 days ending April 30, there were 536 complaints of stopped pipes; working out at an average of 4·4 per day, which was very close to the figure given by Mr. Botley. It even came to somewhat less than his, when it was remembered that in Croydon there were between 10,000 and 11,000 customers, as against 7000 in Hastings. In 1897, for the same period, there were 227 complaints—or an average of 2·3 per day—which, when worked out to the percentage of the number of consumers, was to the second place identical with that given by Mr. Botley. If he had been trying any special apparatus at the time, he should no doubt have been able to say that what he had been doing had been eminently successful; but it so happened that in Croydon they had not been doing anything special to prevent deposition of naphthalene. The usual practice had been to enrich with oil and cannel; and the only difference made this year compared with last was that they used somewhat less carburine—·680 spirit—and somewhat more cannel. But somehow or other, the figures he had given had shown a decided diminution in the number of complaints. He was, afraid, therefore, he must come to the conclusion that, until they had further figures based on a more lengthened experience, and carried out under more adverse circumstances with regard to weather, he could hardly agree that Mr. Botley had proved his case. There was another matter he should like to ask about. Mr. Botley stated that he got no improvement in the gas from an illuminating point of view; but if this was so, where did the naphthalene go to? Mr. Botley stated that it did not deposit; but a little later he said he found on the top of the lamp a little brown discoloration, which was caused by the over-enrichment of the gas due to the naphthalene being carried forward. If it was not carried forward to the burners, he would find it, he presumed, in the syphons; and he said, to some extent, he did. But if it was carried forward, he failed to see why there was not an increased illuminating power produced. He also mentioned that he thought at one time during the summer he was going to get into trouble with the apparatus, as they had a greater number of complaints than during the winter. Probably many of those present would say that

* An illustrated abstract of this specification appeared in the "Journal" for April 27 (p. 943).

IV.—Hastings and St. Leonards Gas Company. Yearly Record of Stoppages.

Year.	Total Stoppages.				Relative Stoppages.				Consumers.		Gas Sold.		Remarks.
	No. of Stoppages.	Average per Day.	Maximum No. in One Day.	Minim'm No. in One Day.	Cold Months.	Average.	Warm Months.	Average.	No.	Rates of Stopp'g's to Consumers	Thousands.	Stoppages per 1000 C. Ft.	
1893. . .	4948	13·55	97 (Sept. 25)	0	2626	14·42	2322	12·68	6084	1 to 0·813	321,969	0·0153	Jan. 3, temp. 16° Fahr.
1894. . .	4167	11·41	228 (Jan. 6)	0	2473	13·57	1694	9·25	6143	0·678	325,485	0·0128	Jan. 5, ,, 17° Fahr.
1895. . .	7125	19·52	129 (Feb. 8)	1	4174	22·93	2951	16·12	6519	1·092	342,657	0·0207	Feb. 8, ,, 15° Fahr.
1896 . .	1667	4·55	21 (Dec. 1 and Aug. 7)	0	725	3·96	942	5·14	6997	0·238	348,771	0·0047	23° Fahr. min. temp. 20 p. cent. due to water.
1897 (to April 25, 115 days).	169	1·46	6	0	..	..	..	..	..	..	Estimated, 140,000	0·0012	C.W.G. plant in use about 11 per cent. Temp. 23°, Jan. 27. 40 per cent. due to water.

V.—Weekly Summary of Carburation.

Week Ending Tuesday at 6 a.m.	Gas Sold. Cub. Ft.	Oil Received.	Oil in Stock.	Oil Used.	Oil Recovered.	Oil Suspended.	Oil Suspende per 1000 Cub. Ft.	Cost of Oil Used.	Allowance for Oil Recovered.	Net Cost of Oil Used.	Cost of Oil per 1000 Cub. Ft. Gas Sold.	Average Minimum Temp. per Week.	Average Temp. of Carburater.
1897.	Thousands.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons	£ s. d.	s. d.	£ s. d.	d.	Deg. F.	Deg. F.
Jan. 5 .	5,846	..	466½	30 (*a*)	22	8	0·0013	0 15 0	5 6	0 9 6	0·0·90	35·6	53·8
,, 12 .	10,467	..	435½	30 (*b*)	12	18	0·0017	0 15 0	3 0	0 12 0	0·0130	38·2	53·1
,, 19 .	10,759	80	486	29½	13	16½	0·0014	0 14 9	3 3	0 11 6	0·0120	30·5	51·2
,, 26 .	11,143	..	439¾	45½ (*c*)	10	35¼	0·0031	1 2 8	2 6	1 0 2	0·0217	25·8	50·0
Feb. 2 .	10,607	40	439	40¾	18	22¾	0·0021	0 19 6	4 6	0 15 0	0·0160	28·1	50·2
,, 9 .	9,789	40	458¾	20¾	9	11¼	0·0011	0 9 9	2 3	0 7 6	0·0091	33·6	51·4
,, 16 .	9,284	40	472¾	26	8	18	0·0019	0 11 5	2 0	0 9 5	0·0120	38·7	51·7
,, 23 .	8,527	40	501½	11½	4	7½	0·0008	0 5 0	1 0	0 4 0	0·0056	36·2	50·6
Mar. 2 .	8,296	..	490	11½	3	8½	0·0010	0 5 1	0 9	0 4 4	0·0062	39·1	54·8
,, 9 .	8,326	..	474½	15½	8	7½	0·0009	0 6 10	2 0	0 4 10	0·0069	32·5	50·8
,, 16 .	7,728	300	595¾	58¾ (*d*)	15½	43¼	0·0055	1 13 7	3 11	1 9 8	0·0460	36·0	52·5
,, 23 .	7,250	..	537¾	58	20½	37½	0·0051	1 5 5	5 2	1 0 3	0·0330	42·7	53·5
,, 30 .	7,022	..	485	52¾ (*e*)	19	33¾	0·0047	1 7 1	4 9	1 2 4	0·0380	41·5	54·8
April 6 .	7,116	..	442¾	42¼ (*f*)	9	33¼	0·0046	1 5 8	2 3	1 3 5	0·0390	35·0	51·8
,, 13 .	6,751	..	396¾	46 (*g*)	14	32	0·0047	1 4 1	3 6	1 0 7	0·0360	37·4	56·0
,, 20 .	6,742	..	349¼	47½	18½	29	0·0043	1 0 10	4 8	0 16 2	0·0280	41·2	61·0
,, 27 .	6,341	..	309¼	40	24½	15½	0·0024	0 17 6	6 2	0 11 4	0·0210	40·5	60·7

(*a*) "Tea rose" oil. (*b*) 1 gallon from stock for works. (*c*) 1 gallon for works. Very cold weather—snow. (*d*) Trial of canneline, fresh "tea rose," 120 gallons canneline for works, "tea rose" at 5½d. (*e*) 10 gallons canneline used. (*f*) 20 gallons canneline used. (*g*) 10 gallons canneline used.

VI.—Working of Town Carburater.

Date.	Time.	No. of Atomizers on.	Temperatures in Degs. Fahr.			Engine Speed.	Pressures.		Oil Used.			Oil Deposited.	
			Carburater.	Room.	Open Air.		Gas.	Oil.	Added.	Height.	Used.	On Drip-Well.	On Outlet.
1896.									Galls.	In.	In.	Galls.	Galls.
Feb. 1 .	8.0 a.m.	4	58	56	45	46	70	30	..	38–36¼	1¼	..	..
	10.0 ,,	4	58	56	46	50	65	25	..	35¼	1¼	..	..
	12.0 ,,	4	58	56	46	42	60	20	..	34	1¼	..	..
	2.0 p.m.	4	58	56	46	46	65	25	..	33	1	..	..
	4.0 ,,	4	58	56	45	48	65	25	..	31¾	1¼	..	.. (*a*)
									7½	Charging.			
	6.0 ,,	3	58	56	44	48	70	30	..	36	2	9	½ (*b*)
	8.0 ,,	3	55	54	44	46	65	25	..	34⅜	1⅛	1⅜	.. (*c*)
	10.0 ,,	3	54	53	43	48	70	30	..	34	⅜	1⅜	..
	12.0 ,,	3	54	52	41	46	75	35	..	33	1	1¼	..
March 1 .	2.0 a.m.	3	54	52	41	48	75	31	..	32	1	2⅛	..
	4.0 ,,	3	53	52	40	42	70	35	..	31	1	2⅛	..
	6.0 ,,	3	53	52	40	42	70	35	16 used oil	30⅛	⅞	2¾	..
	8.0 ,,	4	53	52	40	44	60	20	18 tea oil	25	5⅛	..	..
	10.0 ,,	4	53	52	40	48	65	25	..	24	1	5⅜	..
	12.0 ,,	4	53	52	40	42	60	20	..	20½	3½	..	..
	2.30 p.m.	4	53	52	40	46	65	25	..	16	4½	..	..
	4.0 ,,	4	52	51	38	40	65	25	..	Charging.		16	1 (*d*)
	6.0 ,,	3	51	51	38	46	75	35	..	41	..	1	.. (*e*)
	8.0 ,,	3	51	50	39	46	75	35	..	38½	2½	2¼	..
	10.0 ,,	3	51	50	38	46	70	30	..	36	2½	3	..
	12.0 ,,	3	50	50	38	44	70	30	..	35	1	3¼	..
April 1 .	2.0 a.m.	3	49	49	36	46	75	35	..	34½	½	3⅜	..
	4.0 ,,	3	49	49	36	44	70	30	..	33¾	½	3⅜	..
	6.0 ,,	3	49	50	37	46	70	30	..	33¼	½	3⅝	..
	8.0 ,,	4	50	49	38	48	70	30	..	32	1¼	1	..
	10.0 ,,	4	50	49	38	42	65	25	20	30½	1½	4¾	..
	12.0 ,,	4	50	49	40	48	70	30	..	46	..	9	1
	2.0 p.m.	4	51	50	40	46	69	29	..	43	3	..	..
	4.0 ,,	4	50	50	41	47	70	31	..	39½	3½	..	..
	6.0 ,,	3	50	50	40	48	75	35	..	33½	6	3⅝	.. (*f*)
	8.0 ,,	3	50	50	40	46	70	30	..	33	½	4⅛	.. (*g*)
												2⅜	..
	10.0 ,,	3	49	49	38	46	70	30	..	32½	½	4¼	..
	12.0 ,,	3	49	48	38	46	70	30	..	31½	1½	2½	..
May 1 .	2.0 a.m.	3	49	48	37	48	75	35	..	30⅜	1⅛	2¼	..
	4.0 ,,	3	49	48	37	48	75	35	..	29⅜	1	3	..
	6.0 ,,	3	47	46	36	48	75	35	..	29	⅜	3⅜	..
	8.0 ,,	3	47	46	35	46	70	30	17	27½	1½	3½	..
	10.0 ,,	3	49	48	35	48	75	35	..	26½	1	6	1
	12.0 ,,	3	50	48	36	46	75	35	..	40¼	..	..	..
	2.0 p.m.	3	50	48	36	44	70	30	..	39½	⅜	..	..
	4.0 ,,	3	50	48	35	46	75	35	..	38¾	⅜	¼	..
	6.0 ,,	3	48	47	36	46	75	35	..	38	⅜	⅜	..
	8.0 ,,	3	48	47	36	46	75	35	..	37	1	⅛	..
	10.0 ,,	3	48	47	36	44	75	35	..	36	1	1½	..
	12.0 ,,	3	48	47	35	40	70	30	..	35¼	¾	1⅛	..
June 1 .	2.0 a.m.	3	48	47	34	46	70	30	..	34⅜	⅜	1⅜	..
	4.0 ,,	3	48	47	34	46	75	35	..	33½	⅜	1⅜	..
	6.0 ,,	3	48	46	35	46	74	34	..	32¾	¾	..	..

(*a*) ¾ gallon drip oil; new offices. (*b*) 1½ gallons drip oil, oil-gas plant. (*c*) 1 atomizer shut off at 6 p.m. (*d*) 1 gallon oil, gas plant, Duck lamps. (*e*) 1 atomizer is shut off at 6 p.m. (*f*) 1 atomizer shut off at 6 p.m. (*g*) 3 gallons drip oil for Duck lamps in coke yard.

VII.—Working of Town Carburater.

Date.	Time.	No. of Atomizers on.	Engine Speed.	Temperatures in Degrees Fahr.				Pressures.		Oil Used.			Oil Deposited.		Kind and Quantity of Oil Added, or Disposed of.
				Carburater.	Room.	Open Air.	Outlet.	Gas.	Oil.	Height.	Added.	Used.	On Drip-Well.	On Outlet.	
1896.										In.		In.	Galls.	Gall.	
Feb. 6	6.0 p.m.	4	40	72	75	61	61	75	25	42—38½	..	3½	½	..	..
	8.0 ,,	3	40	72	72	59	60	75	25	36	..	2½	1	..	..
	10.0 ,,	4	40	71	70	57	60	75	25	33	36 in.	3	2	..	..
	12.0 ,,	4	42	70	70	57	59	80	30	33	..	3	3½	..	..
Mar. 6	2.0 a.m.	3	40	70	71	54	57	75	25	31	..	2	4½	..	..
	4.0 ,,	3	40	69	68	58	59	75	25	29½	..	1¾	6	..	..
	6.0 ,,	3	38	68	68	56	58	75	25	27½	..	2	6¾	..	..
	8.0 ,,	3	42	70	71	60	62	75	25	25	..	2½	7¾	..	..
	10.0 ,,	4	42	74	73	64	63	80	30	20½	..	4½	Full	..	..
	12.0 ,,	4	40	72	71	60	63	70	20	17	30 galls.	3½	6	..	Galls.
	2.15 p.m.	4	44	71	72	60	63	80	30	14	..	3	6½	..	10
	4.0 ,,	4	42	74	74	60	62	75	25	33	9 left in cylinder	..	..	1	Drip-well . 19 Cutler . . 1
	6.0 ,,	4	40	72	71	60	61	75	25	31	..	2	1	..	—
	8.0 ,,	4	40	68	68	57	59	75	25	28½	37	2½	2	..	30
	10.0 ,,	4	40	68	68	55	58	75	25	34½	..	2½	3½	..	Tea rose . 9 (a)
	12.0 ,,	4	38	67	68	54	57	80	30	30½	..	4	5	..	..
April 6	2.0 a.m.	3	40	65	66	52	56	75	25	25	..	5½	7	..	..
	4.0 ,,	3	40	65	64	52	56	80	30	20	..	5	Full	..	..
	6.0 ,,	3	38	67	66	54	60	75	25	17½	..	2½	,,	..	..
	8.0 ,,	3	42	69	69	57	62	80	30	11	..	6½	,,	..	..
	10.0 ,,	4	42	71	70	60	63	70	25	4½	63 galls.	6½	,,	..	Benzol . . 30
	12.0 ,,	4	44	72	72	63	64	75	25	12½—7½	10 left in cylinder	5	5	..	Drip-well . 32 Cutler . . 1
	2.30 p.m.	4	42	72	72	60	63	75	25	22—17½	..	4½	6¾	..	—
	4.0 ,,	4	44	74	72	62	63	75	25	43	..	..	..	1	63 (b)
	6.0 ,,	4	42	74	78	62	62	75	25	40	..	3	¼	..	..
	8.0 ,,	6	46	74	72	60	60	75	25	36½	45½	3½	½	..	Tea rose . 10 (a)
	10.0 ,,	6	46	72	70	58	59	75	25	41	..	4½	2	..	..
	12.0 ,,	4	42	70	70	57	58	75	25	35½	..	5½	3	..	..
May 6	2.0 a.m.	3	40	68	68	55	57	75	25	30	..	5¼	4½	..	..
	4.0 ,,	3	40	67	68	54	57	75	25	27½	..	2¾	6	..	..
	6.0 ,,	3	40	65	64	54	58	75	25	25½	..	4	7½	..	..
	8.0 ,,	3	40	68	68	57	60	75	25	20	..	3½	Full	..	Benzol . . 30
	10.0 ,,	4	42	70	69	60	60	75	25	12½	..	7½	3⅞	..	Drip-well . 25½
	12.0 ,,	4	40	72	72	62	62	75	25	5½	56½ galls.	7	6½	..	Cutler . . 1
	2.15 p.m.	4	40	71	71	58	63	75	25	12½—9¼	10 left in cylinder.	3¼	8¾	..	—
	4.0 ,,	4	42	71	71	58	63	75	28	44	..	..	..	1	56½ (b) Drip-well . 3 (c)
	6.0 ,,	4	40	76	78	56	62	70	20	41¼	..	2¾	¾	..	Tea rose . 7
	8.0 ,,	6	48	70	70	55	62	75	25	38	47 in.	2¾	1¾	..	..
	10.0 ,,	6	48	68	68	54	61	75	25	42½	..	4½	3	..	..
	12.0 ,,	3	40	65	64	55	60	75	25	39	..	3½	3½	..	..
June 6	2.0 a.m.	3	40	65	64	54	60	80	30	36	..	3	4¼	..	..
	4.0 ,,	3	40	65	64	52	60	75	25	33½	..	2½	5	..	.. (d)
	6.0 ,,	3	40	65	63	52	61	75	25	31	..	2½	6	..	..
	8.0 ,,	3	40	68	68	55	62	75	25	28	..	3	6½	..	Benzol . . 10
	10.0 ,,	4	44	67	68	58	62	80	30	25	..	3	7½	..	Drip . . 13
	12.0 ,,	4	42	70	70	64	62	75	25	43—42	..	1	..	1	Cutler . . 1
	2.0 p.m.	4	38	68	65	60	63	82	25	38¾	..	3¼	1¼	..	—
	4.0 ,,	4	36	68	68	58	63	75	30	35¼	..	3	2¼	..	24 (b)
	6.0 ,,	4	37	67	69	59	63	76	30	32½	..	3½	3	..	Tea rose . 10 (a)
	8.0 ,,	4	36	65	68	57	61	76	30	29½	38	3	4	..	..
	10.0 ,,	4	36	65	65	54	59	78	31	34½	..	3¾	5¼	..	..
	12.0 ,,	4	37	64	64	54	56	75	30	31½	..	3	6½	..	.. (e)
	2.0 ,,	4	37	63	62	53	56	75	30	28½	..	3¼	7¼	..	..
	4.0 ,,	3	36	63	61	54	56	76	31	24½	..	3½	8½	..	..
	6.0 ,,	3	35	62	61	54	56	76	31	22½	..	3	Full	..	..

(a) Left in cylinder. (b) Charged. (c) Left in cylinder; 1 c.p. increase. (d) Three atomizers off at 11 p.m. (e) One atomizer off at 3 a.m.

VIII.—Carburation. Solubility of Naphthalene.

No.	Substance.	Weights. (1) Vessel Empty.	(2) Dr-ss with Oil.	(3) Net Oil.	(4) Gross Oil and $C_{10}H_8$.	(5) Net $C_{10}H_8$.	Increase per Cent.	Remarks.
1	Rectified benzol (1)	23·270	66·536		71·190			Increase in vol. (50 c.c. original) rendered it necessary to remove some benzol before last weighing.
	(B)	20·590	23·270		3·520			Weight of oil and flask = 24·110, Jan. 28, 1896.
		43·860		43·266				,, flask only = 20·590, Feb. 8, 1896.
					74·710			3·520
					66·536			Two flasks, total weight = 43·855
						8·174	18·890	
2	Tea rose ·790 sp. gr.	24·250 (residue)	63·727		66·020			Jan. 16, 1896, to Feb. 8, 1896.
			24·250		63·727			
				39·477		2·293	5·808	
3	Coal-tar naphtha .	23·310	69·543		73·680			
			23·313		69·543			
				46·233		4·137	8·940	Checked Sept. 16, 1896.

Results of First Experiment in January, 1896.

700 super canneline . . . . . 8·110 per cent.
790 tea rose. . . . . 5·780 ,,
Benzol 90 per cent. . . . . 8·207 ,, (not saturated).

the number of complaints they got, at any rate, during August and September, when there were hot days and cold nights, would be far greater than in the winter. On the whole, he did not think Mr. Botley had proved his contention that it was far easier to carry on the enrichment during cold weather than during hot.

Mr. THOMAS GLOVER (West Bromwich) said he had been looking into this question for some time, and was sorry for some reasons he was not able to offer to the Institution the result of the investigations which had been going on by himself and some of his friends. But he hoped at some future time to give the result of these investigations, and to show what he believed was the cause of the naphthalene difficulty. The paper now before them showed that the authors had made the boldest attempt at solving the difficulty; and he could only express his admiration at the perfection of the mechanical details, and the way in which they had gone about it. At the same time, he did not think they had got to the bottom of the question. They did not seem to have given any chemical or physical reasons for the deposition of naphthalene. He noticed that, early in the paper, the authors stated "In such cases as this typical one, it is vain to seek for a reasonable solution." He held that there was a reasonable solution for the deposition of naphthalene in every case, and they had only to make a proper study of the matter to find the reasons which lay at the bottom of this; and only then, in his opinion, could they apply the right remedy. A good deal might be ascertained by studying the question, which had no doubt occurred to many, why it was that some coals gave naphthalene, and some did not; and that some districts where certain coals were carbonized were troubled with it, and others were not. He was convinced that there were chemical and physical reasons for the deposition of naphthalene in the solid form. The paper divided itself into two parts. The troubles on the works were described in the early part of the paper; and they were overcome by certain improvements in condensation. There, perhaps, was the clue to overcoming the difficulty in the best form. It was by condensation where the gas was removed from the tar, that the remedy had to be applied. He noticed also that the troubles on the district had been accentuated by the higher heats; and that had been found all over the country. Now, it struck one that these oils were very heavy to add to a gas which was fairly saturated to begin with; and that, even if the oil were not added in the form of rain, but as mist, still, when the conditions under which the gas was distributed were altered—when the temperature was once lowered—he feared that the mist would, as it always did under lower temperatures, turn into rain, and would not only drop itself, but would also bring down other hydrocarbons, including naphthalene, and he believed that was found in the drip-boxes. This was a question of vital interest to all gas engineers. The system which had just been described to them would no doubt palliate the trouble of naphthalene deposits; but if the question was tackled in a somewhat different form, very probably the evil might be entirely overcome.

Mr. H. WOODALL said that as bearing on the question which had been raised by the first speaker, he should like to mention a little personal experience. One night, out of about 350 lamps, he had 300 out with naphthalene; and those that did go out, sometimes went out three or four times in the night—in fact, the lamplighters were about all night. During the same evening, he went over to Hanley—the districts being separated by only about 60 yards—and found they had not a single lamp out. So when he returned to Burslem—having noticed that in Hanley the taps were inside the lanterns, while in Burslem they were outside—he called his lamplighters together, and inquired if there were any lamps in Burslem which had the tap inside the lantern. They told him there were four outside the Institute. He asked if any one of them was out; and they said "No." He believed that there was the solution of the difficulty. He thought he would not go to the trouble of altering the position of the lamp-cocks; but, instead, he got a specially made lamp-cock having a large barrel, with an orifice through the plug, which would almost take a lead pencil, and this was finished, instead of being left as a rough casting. He put these new lamp-cocks all through the district; and since then he had never been troubled with naphthalene in the lamps.

Mr. A. DOUGALL, jun. (Tunbridge Wells), said he had hoped to be in a position to give some information with regard to the application of this process at Tunbridge Wells; but unfortunately, through various delays, the apparatus had not been brought into operation until a few days ago, so that he could not give any results, and could scarcely say he spoke from experience. They had always had naphthalene on the works. At one time, it confined itself to the condensers; but now they had it not only there, but in the scrubbers and in the pipes of the gasholders. The cost of removing it from time to time was considerable, apart altogether from the loss occasioned by the interruption in the manufacture of gas. On consulting Mr. Botley, and seeing what he had done at Hastings, they decided to try the process. A place was found for the apparatus between the retort-house main and the condensers; and there it was fixed, to deal with the whole of the gas at the inlet to the condensers. The condenser was the first place where the naphthalene was deposited; and they were hoping, by the addition of oil vapour, to so increase the tension of the gas as to retain the naphthalene and other vapours which had hitherto been thrown down. The apparatus, which had been so clearly and minutely described by Mr. Botley, was easily manipulated, and required very little attention. Once having filled the cylinders with oil and regulated the pressure, it only required a little attention occasionally, to see that the atomizers worked all right. Altogether it was a most ingenious arrangement—very simple, and easily managed. The results so far in his case were most encouraging; and he hoped that they would derive much benefit from this addition to the plant. At present, they were using ·775 oil, and had discovered traces of it in the gas up to the inlet of the purifiers; but they had not yet found it in the gas as it left the purifiers. He, like Mr. Helps, was struck by the remark that carburation for naphthalene, properly carried out, had little practical effect on the illuminating power. This, he thought, could only apply to cases where the naphthalene was formed in very small quantities, where the variation in illuminating power was so slight as to be difficult to detect. If naphthalene deposited, surely the gas must be impoverished to that extent; and if by the addition of oil vapour the naphthalene could be brought to the point of combustion, surely there must be a corresponding increase in the illuminating power. He was going to say that they made naphthalene as a bye-product; but perhaps this was rather too strong. At all events, he often felt that they had more than their share; and if Mr. Botley was able to deal effectively with their case, he would have mastered a difficult point.

Mr. A. F. BROWNE (Rotherhithe) said he must join in the chorus of congratulation to Mr. Botley on the admirable way in which he had applied himself to solving the terrible difficulty which had confronted him at Hastings. As they had been reminded the night before, "Necessity is the mother of invention." Evidently the necessity did exist; and Mr. Botley had given a few hints as to what led his thoughts in the direction which he had ultimately brought—mechanically, at all events—to such a state of perfection. He thought, with Mr. Helps, that greater time must elapse before they could be convinced that this process was to be credited with all the results which it appeared to have brought about. But if they compared the stoppages of 1896 with those of the year that preceded it, they could not fail to be struck with the fact that the nuisance appeared to have been reduced in amount nearly 80 per cent. This was an extraordinary state of things; and he sincerely hoped the improvement would be permanent. Mr. Botley seemed to have cleverly availed himself of the condition of things which was a trouble in condensation—namely, the difficulty of removing liquid in a highly divided state which was carried forward through the condensing plant right up to the washer. He evidently looked on naphthalene as a microbe, and had set himself to find another microbe which should follow it to its inmost fastnesses, and render it harmless; and he appeared to have succeeded. He must congratulate him on the able way in which he had directed his apparatus to produce this mist; and there was no question that such a mist would travel in the current of gas for a great distance in the district mains. He thought it was due to the greater speed of the current that they were able to add a larger quantity of atomized oil to the gas in the winter than in the summer, though he did not think the table made this

fact particularly clear. It appeared to him it showed that, when working at the highest temperature, Mr. Botley was able to retain in his gas a greater amount of oil, and that the percentage of oil recovered did not exceed that which was recovered during the cold weather. During the week ended March 23, in which the average temperature was 42·7°, he suspended 0·0051 gallon per 1000 cubic feet, which was the largest quantity. The lowest temperature was 25·8°; and then he suspended 0·0031 gallon. When he came to the theory, as had been already pointed out, they would be glad to know how these things were brought about. It was seductive, but dangerous, to venture on theories with regard to naphthalene. Mr. Botley said naphthalene would not crystallize in the presence of certain hydrocarbons; and he seemed, he (Mr. Browne) must confess, up to the present to have proved it. They would all be glad if he went on, and told them the reasons why. Mr. Botley stated that, in his opinion, it was due to an alteration of vapour tension. But as he also told them that the oil which he chiefly employed was not volatile—that it would not vaporize—he could not see how it could affect the vapour tension, unless it had the power as a mist of absorbing or dissolving a portion of the vapours already existing in the gas, and thus reducing their quantity in the volume of gas—that is to say, bringing the vapours somewhat further below the point of saturation. If this was the meaning, it was a direction in which they might suppose the process worked. They might also imagine that if naphthalene existed in coal gas as a solid in a very finely divided form—as they had heard of late from a high authority—the atomized oil would seize on these finely divided particles and dissolve them, and thus carry them forward with it as part of the mist itself. No doubt, the minute drops would be increased in diameter and density; but if the speed of the gas were sufficient, they might yet be carried on to the burner. But then came the difficulty which had already been referred to—Why, if this was the case, did not the illuminating power improve proportionately? He should be glad to hear if Mr. Botley could give any explanation on the point.

Mr. T. S. Lacey (Pimlico) said that very few people who made cannel gas of over 20-candle power were ever troubled with naphthalene in the solid form. Though there was an enormous amount of naphthalene in the tar, and also in the gas when the naphthalene came down, it was always accompanied by a sufficient amount of liquid to keep it in solution. The trouble only arose when it was deposited in the solid form, and caused stoppages. If when it came down it was accompanied by a sufficient amount of liquid to prevent it solidifying, it did no harm; and it seemed to him this was one of the things which this process did—or might do, at any rate. Another way in which it might prevent the formation of naphthalene in a solid form, was by preventing crystallization; and there was no doubt that the crystallization of naphthalene was much assisted by its being deposited on a rough surface. If the whole interior surface of the mains could be coated with some oil, one could imagine it would be very unlikely that naphthalene would collect.

The President said the paper was a very interesting one, and the discussion was quite worthy of it; but it must now come to an end. Before calling on Mr. Botley to reply, he would only say that he cordially agreed with Mr. Glover that if, by further investigation, the causes of the separation of naphthalene could be more clearly laid down, the Institution would welcome another paper on the subject. He also shared with him the regret that it should be stated that in any case—especially a typical case—it was "vain to seek a reasonable solution." He (Mr. Woodall) thought that must have been a slip of the pen, for it was not a sentiment which would commend itself to any member of the Institution.

Mr. C. E. Botley said he would very briefly reply to generalities, and leave his son to deal with other matters. The President had quite expressed his idea; it certainly was not vain to seek for anything. It was a slip of the pen. They hoped to seek for a solution still, and trusted to solve the problem absolutely. He could only say that, so far as affected Hastings, they had always previously been troubled with naphthalene there. At Croydon, they appeared to have had it occasionally; but at Hastings there had never been any variation. With regard to the weather, it would be found from the chart suspended that they had had great extremes—more especially in October, 1895. As to the illuminating power, the alteration only referred to the inlet and outlet of the carburater. On the district, there was undoubtedly an increase of illuminating power—especially while the naphthalene was being used up. So far as the reports brought to him by the different foremen in the departments went, the foreman of the mains reported that there was no naphthalene in the mains now. The foreman in the fitting department said he did not know what naphthalene was now, and any blow-outs were simply stoppages which would occur from various causes. With the idea of making this a thoroughly practical paper, perhaps the best side had not been made of the process; but everything possible had been stated against it. The process had been in actual use now for a year and a half, which was, he thought, a reasonable time. He might have delayed giving any results for another year, had he not been pressed on all hands to make known what had been done so far; and he could only say he had every confidence in the process.

Mr. C. F. Botley said his father had already replied generally to Mr. Helps; and he would ask him if he had considered 120 days was a sufficiently long time by which to judge results. They had the results for the years 1893 to 1897 down to the present time. These showed that there was a real necessity to go into the question at Hastings. It was not a sort of thing which, if left alone, might cure itself. Mr. Helps further said that more cannel was used this year; and he thought this was in the right direction, for he firmly believed that cannel was a cure for naphthalene. With reference to the weather, he did not think Mr. Helps could have had the weather they had had at Hastings; for if he would look at the chart, he would find quite as great extremes of temperature as one could wish for. But for this apparatus, they would have trembled many nights thinking of the letters they would receive in the morning. As to the illuminating power, the brown discoloration was, of course, due to the naphthalene which existed in the stand-pipes which had been cleared away. At present, it might be said there were no deposits to be cleared away; and therefore the oil mist simply caused naphthalene to be retained in the gas. The proportion of oil never exceeded 0·005 gallon per 1000 cubic feet, which was sufficient to retain the naphthalene; and it was obvious that the illuminating power could not be expected to be increased very much. The amount was so small, that it would be difficult to get at. If there were any means by which it could be detected, he should be pleased to know it. The question had been raised about the summer naphthalene. At Hastings, they did not have the same trouble with it in the summer as in the winter (see Yearly Summary); but, of course, the specific gravity of the gas was lower in the winter, and this helped the process very much. It was, perhaps, not quite as clear as it might be; but for the purpose of preparing his paper, there was one week in which they particularly used a light-grade oil, in order to see the difference in suspension. In that week, they suspended 43½ gallons of oil—equal to 0·0055 gallon per 1000 cubic feet—though the cost was greater, owing to the fact that it was a more expensive oil. The temperature the following week was very low; but next week they did not use any light-grade oil, and yet the suspension, owing to the temperature, was much the same. In fact, they knew the prevailing temperature from the quantity of oil taken up. There was not the slightest doubt—independent of the consumption which one gentleman referred to at Hastings last year—the temperature of the gas was a powerful factor in the question of the amount of oil mist suspended. He much regretted that Mr. Glover should think they were of opinion there were things not worth looking after. This was a misprint. In the then condition of things, they were glad to do anything to get out of their trouble. He did not think a day passed but what they considered it in some aspect. Mr. H. Woodall had referred to the question of lamp-cocks; and they had tested that at Hastings. There was no doubt if the cocks were screened, it in some way prevented the naphthalene being deposited just there. Mr. Dougall had been good enough to try the apparatus; but he was not yet in a position to say much about it, because the proportion of oil taken up was so small that, of necessity, it must be a long time before one got any permanent result. Mr. Browne had made several important suggestions; and he would point out to him that crystallization, so far as he knew, was always accompanied by water. It seemed to

him if there were any means of preventing this water, they would to a great extent prevent crystallization. He had pointed out that these theories of naphthalene were dangerous to attack; but with regard to the rise of vapour tension, he would point out that this was an artificial one, which was, of course, produced in the way Mr. Browne explained. Mr. Lacey's remarks were very much to the point. If the interior of the service-pipes were coated with an oily film, that would no doubt prevent the deposition of naphthalene. If one tried to make naphthalene crystallize on a pipe which had oil inside, it would be found to be impossible; and if naphthalene really existed in a finely divided state, it was impossible for it, in the presence of the oil mist, to be deposited except as a solution.

We have received from Mr. C. F. Botley, the following additional remarks on the subject of the paper: I fear my reply to the discussion, which had to be brief, owing to the limited time, was not so clear as is desirable in respect to Appendix V.—the "Weekly Summary of Carburation." It should have been pointed out that, in order to show the possibilities of carburation for the weeks ending Feb. 23, March 2, and March 9 respectively, no fresh oil was used; the oil from the drip-well being put in over and over again to work it up to ·840. The more usual custom is to add some fresh oil regularly; the drip-well oil, &c., being employed for other purposes. For the week ending March 16 and afterwards, some canneline was used; hence the higher suspension. The effect of temperature on the suspension is more marked at the end of January and the beginning of February.

ON MODERN METHODS FOR THE HANDLING AND STORING OF COALS.

By F. D. Marshall.

At the meeting of this Institution held in May, 1895, the writer had the honour to read a paper dealing with the principles of the Monier system of construction as applied to gas-works and kindred industries, and especially as applied to the coal-stores of the new Frederiksberg Gas-Works of the Danish Gas Company. It was then pointed out that the coal-stores described were supplementary ones; and that it was arranged to store the bulk of the coals at another place, and to transport them daily to the works as required, where they were handled and stored by the method then described. It is the writer's intention in this paper to bring before the meeting certain novel machinery now in course of erection for discharging the bulk of the coals from steamers, and storing the same before eventual transport to the gas-works.

Machinery of the magnitude about to be described, was in excess of what was required by the gas-works; and an arrangement was therefore made with the Danish Coal Company (a branch of the Free Harbour Company, of Copenhagen), by which the Coal Company undertook to erect the installation at their expense, but on such a scale that, in addition to coal for the gas-works, a large proportion of that coming to the port of Copenhagen could be discharged and stored by the machinery in question. The space and accommodation required for the undertaking was found in the Copenhagen Free Harbour (after Hamburg, one of the most commodious docks in the world), affording a constant depth of from 26 feet to 30 feet of water at all seasons and at all times.

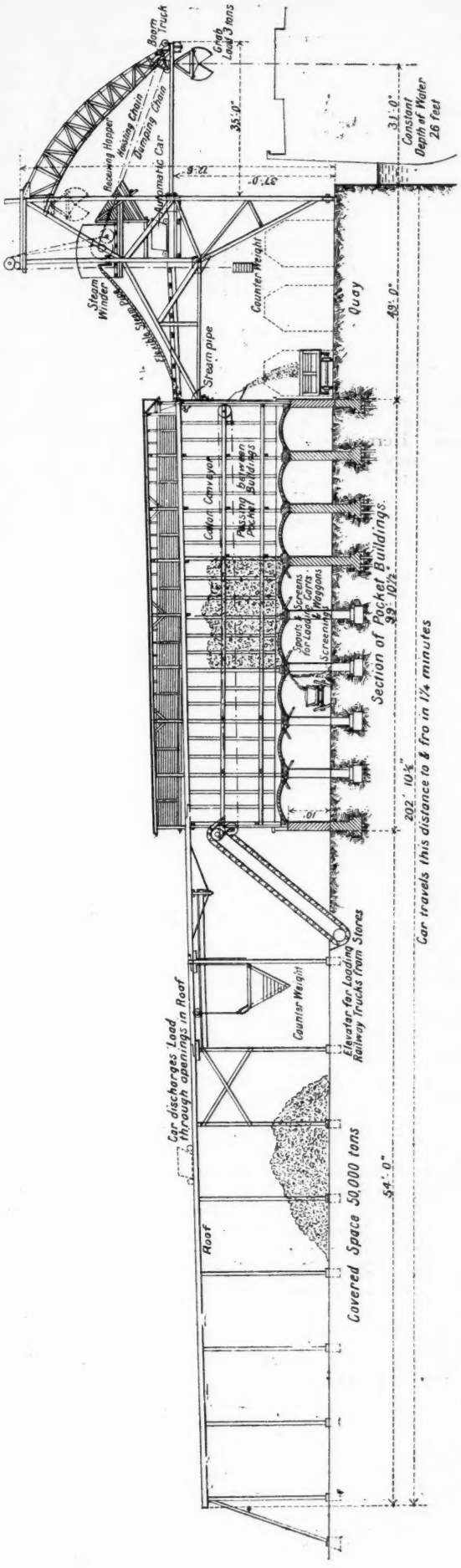
Before the designs of the machinery were decided upon, the writer and others interested in the matter visited what were considered the most modern installations, both in England and on the Continent; and in the meantime a delegate was sent to America to inspect in that direction. In England, the impression prevailed that coal discharging and storing was expensively conducted; the coal being for the greater part raised by buckets or tubs hoisted by hydraulic or steam cranes. The nearest approach to perfection on this side of the Atlantic was considered to have been attained in the splendid installation of machinery erected by Herr Possehl, of Altona and Hamburg. This system lifts the coal from ships or lighters by means of a moveable elevator, which dips into the hold of the barge or ship; discharging its elevated load on to quick-running conveyor bands, and depositing the same into overground "pockets" or bins erected on the quay side—the pockets being so constructed that the discharge into railway trucks or horse vans may be easily and economically conducted. The whole installation is one of the most unique and perfect imaginable; and by the courtesy of Herr Possehl, every facility was afforded for examining his "Kohlenhof." There appeared, however, one great drawback to this plan, in its being designed for handling only *household* or *screened* coals; the elevator being unable to lift large pieces of unscreened coal. As it was desired to handle gas and other descriptions of unscreened coal of equal size, the installation was unsuitable to those requirements which the author had under consideration.

Attention was next directed to America, where, in the opinion of the writer, coal handling and storage has reached a perfection not known in this country. In 1893, Herr N. O. Petersen, the Manager of the Western Gas-Works of the Copenhagen Municipality, visited America; and as a result of his visit, he erected at his works the C. W. Hunt system of discharging and storing gas coal. Owing to his favourable experience, and the information kindly placed at the disposal of the author and his colleagues, the Hunt system was finally decided upon for the large installation at the Copenhagen Free Harbour, with, however, certain modifications and innovations, all conducive, it is hoped, to making the plan more effective and economical. Herr Petersen's machinery was, to a certain extent, a very rough and ready installation; the cranes being constructed of wood, and the coal hoisted by tubs or buckets—the steam-shovel with which he was supplied proving too complicated a machine to work successfully. But notwithstanding this, it is an apparatus which, as figures quoted later amply prove, yields good returns.

The machinery about to be described is on a much larger scale; six cranes, all of steel framing, being employed, lifting steam shovels weighing 3 tons each—the dead weight with a load of coal being 5 tons. The automatic cars are also constructed to carry 2 tons, as against 1 ton previously employed; and the coal is discharged into bins or "pockets" constructed in a manner not hitherto employed. Herr Petersen's machinery (two cranes) is capable of hoisting from 60 to 80 tons per hour; whereas the six cranes under construction can easily hoist 500 to 600 tons per hour, or nearly 100 tons per crane per hour. This is a very great advance; but if Mr. C. W. Hunt could have had his way, he would have preferred to provide machinery to hoist 5 tons of coal instead of 2 tons, or a dead weight of 7 tons. But a line had to be drawn somewhere, much to the New York firm's disappointment.

The installation, in detail, may be said to consist of six transportable crane or elevator towers, fitted with 100-horse power effective steam winders and counterweights, each lifting 2 tons of coal per hoist; the dead weight of the steam shovels and coals being 5 tons. Thirty-six automatic railways, with self-dumping cars, containing 2 tons. Three large buildings, each containing nine bins or "pockets." Each building to contain 10,000 tons of coal, or a total of 30,000 tons. A large covered coal-store behind the building, served by eighteen lines of tracks. This store to contain 50,000 tons of coal. A battery of steam-boilers of 600-horse power effective. Office buildings, railway sidings, &c.

Elevator Towers.—These are six in number, constructed of steel framing, 75 feet high from quay level, and running on a line of rails parallel with the quay front. Each tower is fitted with an outrigger or boom projecting 32 feet over the water, and hinged so as to swing in and out of the way of ships' masts and yards, while the latter are being berthed. The outrigger or boom is of a peculiar shape; a portion being a section of a parabola, and so constructed that the pull of the chain from the 100-horse power steam winch fixed in the head of the tower causes the boom truck or carriage to run up the boom as soon as the steam-shovel is hoisted as high as its outer extremity. To effect this, the winder must be fixed in a certain position as regards the radius of the parabola. To the steam winder are attached two ropes or chains of peculiar make, of stamped flat links, the one being the chain hoisting and the other the dumping chain actuating the steam-shovel. To lighten the load on the steam winch, recourse is had to a counterweight wound on the conical pulley attached to the winder. This counterweight runs to the ground between the legs of the elevator tower. Should it be desirable to employ tubs or a steam-shovel raising only 1 ton of coal, the counterweight is detachable. The steam-winders run at the rate of 200 revolutions per minute. It will be noted



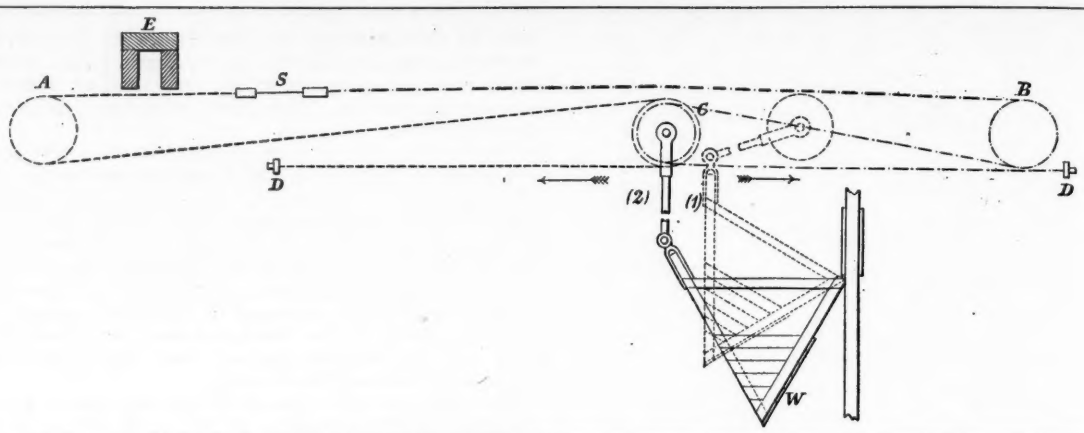
that the elevator towers are furnished with a "hind leg," running along the ledge of the buildings. This arrangement is to give stability to the structure, as well as to allow of the passage of three lines of railway trucks along the quay front.

Steam-Shovel.—The steam-shovels are of a very simple construction, different to the Priestman and other grabs of complicated construction. The opening and closing is effected by the dumping chain, which simply passes round a drum or worm-wheel fixed in the axes of the halves of the shovel. The shovel gapes 6 feet when extended; but it has been ascertained that it can easily pass the hatchways of all modern steamers of a certain tonnage. On reaching the top of the parabola boom, the shovel tips its load into the wooden hopper, from which the coal is emptied into the automatic cars.

Automatic Cars and Tracks.—These cars are of peculiar construction (the invention of Mr. C. W. Hunt, of New York), and are made to discharge their load quite automatically by causing the sides to open by means of a "tripping block;" the sides being fastened by a wire rope attached, not to the sides of the car, but to each other. Both sides must then of necessity open together. The car has a ridge in the centre, so that when the sides are open the load must be discharged. The cars are built of wood lined with sheet steel, with self-adjusting bearings, rubber springs, and steel axles. They can run on a curve of 30 feet radius as easily as on a straight track. The cars in question contain 2 tons of coal, and are the largest yet constructed. The car having been loaded from the hopper and weighed, starts at a push from the man at the hopper on its journey down an inclined track; and, without any further help whatever, makes its journey at the *rate of 300 feet in 35 seconds*, dumps its load, and returns without delay to its starting point. This is effected in the most simple manner, by means of the automatic railway.

Automatic Railway.—The rails on which the cars run are light, narrow-gauge tracks, 22 inches between the flanges of the wheels; and it matters little whether the tracks are curved or straight, evenly or unevenly laid. It is a self-acting railway, operated entirely by gravity; sufficient energy being stored up by the impetus of the loaded car descending an inclined track, to return the car after its load has been discharged to its starting point. The method of doing this (the invention of Mr. C. W. Hunt) is both novel and ingenious. When the loaded car has reached the end of its journey, it has *raised a weight to a certain height*, by means of a cable of wire rope, which the car picks up running down the track. The weight only rises a limited distance; its object being to give the car a start back the moment it has discharged its load—the momentum of the car carrying it the remaining distance. The details may be more fully explained thus (see diagram next page): The car has fixed on the front two horns or grabs; and these, a little before the car arrives at the "tripping-block" E, where it is emptied, catch on to a sledge S attached to the cable which passes over the pulleys A B. The ends of the cable, after passing round the moveable pulley C, are fixed at the points D D. The moveable pulley C runs on a rail fixed to a beam under the railway; and to the axle of the pulley a triangular wooden box W is attached by one corner—the opposite corner being hinged to an upright post, and the box weighted with stones. Now the loaded car having been started, it runs at full speed until the projecting horns catch the sledge S, carrying this along until the tripping-block E is reached. By this action, the pulley C is moved in the direction of arrow No. 1; and at the same time the weight W is lifted into position, as indicated by the dotted lines. The car having dumped its load, by the tripping-block loosening the wire-rope "trippers" attached to the car, has no longer any power to keep the weight W elevated; and this, in falling, causes the direction of the cable to be reversed—the pulley C returning in the direction of arrow No. 2. By this action, the sledge S gives the car a good push, powerful enough for it to overcome the resistance of the incline and to return it to its starting place under the hopper. Wherever the tripping block is placed on the track, there will the car unfailing discharge its load. The weight W may be fixed at any convenient spot, and the weight of stones required be ascertained by experiment.

Coal-Pockets.—The arrangement of coal-pockets under construction will consist of three separate buildings;



each containing 18 pockets, or "silos." These pockets will hold roughly 550 tons of coal, or 10,000 tons in each building; the total quantity in the three buildings being 30,000 tons when quite full. Over each pocket runs two sets of automatic tracks—36 in all. Eighteen of these tracks are continued through the buildings to the large covered space beyond. This space is calculated to store another 50,000 tons; making the total storage 80,000 tons. The designing of the pockets was the occasion for much earnest consideration; there being a choice between iron, wood, and composite structures. The pockets of Possehl's stores at Altona are of iron framework, with concrete wall divisions. But this was an extremely costly affair; and as the installation now being described was so much more extensive, a cheaper form had to be adopted. Iron is objectionable, on account of expansion and contraction in the event of the coal becoming heated; while a wholly wooden structure (as adopted in America) is unsightly. The surroundings in the Free Harbour possess a large degree of architectural merit; and as it was necessary that the pocket buildings should follow the style, it was determined to construct the outer walls of Monier cement work, resting on substantial red-brick and granite foundations, and the internal division-walls of timber-work.

The outer Monier walls are 11 cm. thick; the wire-work netting embedded in the cement consisting of tension-rods 12 mm. thick, kept apart by distance-rods 5 mm. thick, interlaced in the manner of basket-work. The walls are calculated to stand a lateral thrust of 461 kilos. per square metre at the top, 800 kilos. per square metre in the middle, and 1077 kilos. per square metre at the bottom. When the pockets are quite full, and although they may perhaps bulge under this great strain, there is no fear of their giving way. The walls are tapered; being thicker at the bottom than at the top. The bottoms of the walls are anchored in the pediment of brickwork in cement. The walls are strengthened vertically and laterally by I-irons, and by wall-plates through which ¾-inch bolts are passed, bolting the whole of the outside shell to the framework of strong wooden beams forming the interior. These beams likewise support the divisions of the pockets.

The bottoms or floors of the pockets consist of a series of Monier arches, 10 ft. 6 in. span by 2 ft. 6 in. rise, springing from channel-irons resting on concrete piers. The arches at the crown are only 5½ inches thick, and are calculated to stand a strain of ¾ ton per square foot. The Monier network of the arches consists of tension-rods 8 mm. thick, and spacing rods 5 mm. thick. To prevent the arches flattening out, a series of tie-rods, 1¾ inches in diameter, spaced 14 inches from centre to centre, are employed; the ends being screwed and bolted to the channel-irons previously mentioned. At certain points over the concrete piers which support the pocket superstructure, the arches are cut away for the introduction of a channel-iron frame. These frames are for attaching the shoots and screens necessary for emptying the pockets of their contents into the carts or waggons stationed underneath. In this respect, the installation resembles the arrangement of Herr Possehl. It is not quite so beautiful, however, as the space under the Altona pocket, which reminds one of the marble halls of the poet.

The roofs of the pocket buildings are constructed as a series of dormers, through which the automatic tracks enter. The roofs are covered with roofing felt. Additional discharging spouts and screens are fixed in the gable ends of the buildings, for the purpose of discharging coal into railway trucks, of which 30 in number can be accommodated on the lines running parallel to the quay. Everything is arranged to discharge the contents of the pockets or coal direct from the elevator into vans or railway trucks with a minimum of expense and labour. As previously mentioned, the covered space behind the pocket buildings is destined to store 50,000 tons of coal, deposited by 18 lines of automatic tracks carried on trestles. At certain points on this space, corresponding to the openings between the pocket buildings, will be constructed elevators and conveyor bands, to convey the deposited coal to the railway trucks on the quay side; it having been found inconvenient to divert the railway to the space in question.

Now, the question naturally arises, What will this installation cost, and will it pay the interest on the capital? The cost of the entire installation, including cranes, pocket buildings, automatic railways, boilers and house, offices, stores, &c., may be put at £55,000. To answer the latter question, reference must be made to the profits derived from other similar, but not so complete nor perfect, installations. The writer is permitted to refer to figures courteously placed at his disposal by Herr N. O. Petersen, Engineer to the Western Gas-Works of the Copenhagen Municipality, and to the results obtained in America by Mr. Story, of Brooklyn. It must, however, be clearly borne in mind that Herr Petersen hoists only 1 ton at a time, and this by means of tubs or buckets; whereas the machinery described will lift 2 tons per hoist by means of grabs.

To appreciate the gain of the modern, as compared with the old, system in vogue in the port of Copenhagen, the following comparison is necessary. How the Copenhagen figures compare with the figures in other ports, the writer cannot say; but he opines that there cannot be a vast difference. To work a 1000-ton ship on the old plan, five gangs of 16 men each are employed; and a gang would be distributed as follows:—

4 men in hold filling tubs.	
5 men at hand-winch.	
1 man guiding tubs and tipping into barrow.	
6 men wheeling into coal store.	
Total . .	16

In the event of barrows having to be weighed, one man extra for each gang.

The cost of this performance works out as follows:—

Filling tubs and trimming	0s.	5¼d. per ton.
Hoisting	0	6¼ ,,
Deck hand.	0	1¼ ,,
Wheeling	0	7½ ,,
Weighing and foreman	0	1½ ,,
Total . .	1s.	8¼d. per ton.

According to Herr Petersen's experience, the cost of doing the same work by the automatic railway is:—

Men required:

1 engine driver.	
1 man at hopper.	
9 men in ship.	
Total . .	11

Cost:

Filling tubs	3¾d. per ton.
Deck hand	0½ ,,
Engineman.	0½ ,,
Hopper	0½ ,,
Weighing	0½ ,,
Boilers, coal, oil, &c., foreman	1 ,,
Total . .	6½d. per ton.

These figures, it must be clearly understood, are based on lifting the coal with 1 ton tubs or shovels (not steam-shovels).

To ascertain the saving by employing *2-ton steam-shovels*, reference must be made to a letter received from Mr. Story, of Brooklyn, U.S.A. He writes, Oct. 14, 1896:

> We unloaded a boat recently, containing 650 tons, in 8 hours, or at the rate of 80 tons per hour, with the 2-ton steam-shovel.
> Employed were:
> 2 men in vessel, shifting vessel and trimming coal from under cabins, shaft tunnel, &c.
> 1 engineman.
> 2 men at automatic cars.
> 1 boilerman.
>
> Total 6
>
> Total cost of discharging vessel, 2⅕ cents.—say, 2¼d.—per ton; and this at the American rate of wages.

Of course, there is the wear and tear on the machinery and apparatus to be considered; but, at the outside, this could not be reckoned higher than ¼d. per ton.

Assuming the six cranes are at work, a minimum quantity of 480 tons per hour can be discharged, or 4320 tons per working day (nine hours). Allowing the cranes to be working six months in the year, or, say, 180 days, the total quantity unloaded will be 180 × 4320 tons = 775,000 tons. It is not, however, anticipated that during the first few years the annual quantity discharged will amount to more than 500,000 tons.

As the ships entering the port of Copenhagen for the purpose of discharging coal are bound by the rules of the port to contribute 8d. a ton towards the cost of unloading, it is evident the profits to be expected from discharging steamers are not inconsiderable, and that the installation will speedily show a good balance-sheet.

The installation generally is being carried out under the writer's superintendence. It is expected that the machinery will be ready in July; and any one interested in the matter is cordially invited to pay Copenhagen a visit.

Discussion.

The PRESIDENT thought they would all join in congratulating Mr. Marshall that, as the result of the work done in connection with his own gas-works, he had been invited by the people having charge of this important work to join them as technical adviser. The business was being put in hand with great vigour; and he was sure that any member of the Institution who accepted Mr. Marshall's invitation and visited Copenhagen, would be fully repaid for all his trouble. He had an opportunity some time ago of seeing the installation at Mr. Petersen's works at Copenhagen, where the Hunt American apparatus was in full work; and anything more charming than the working of the automatic railway and the tipping arrangements, could not be conceived. He hoped that this system would have the success which was anticipated.

Mr. G. E. STEVENSON (Manchester) said he could not refrain from expressing his gratification at hearing this paper. It was by far the most interesting description of machinery designed to deal with coal that he had ever seen. It would ill become him to criticize the methods adopted, which seemed to him very ingenious; and he could well understand that large economies would be effected in discharging the steamers. One point seemed very surprising—namely, the heavy charge made on the owners of steamers for unloading—and he should like to ask Mr. Marshall, if the cost of discharging were so much reduced by these means, whether the 8d. per ton would be continued permanently. It would seem rather a piece of irony that they should be made to contribute towards discharging ships a larger sum than it actually cost; and probably this charge would not be continued. The only thing which occurred to him as being the weak point in this construction, was the amount of timber used in building the bins. Reference had been made to the effect if the store were constructed of iron and the coal heated; but what would be the result on the woodwork if the coal heated? With this passing remark, he thought the whole thing was perfect, so far as one could judge. He might also call attention to the large amount of dead weight in the machinery to be lifted apart from the material—the steam-shovels weighing 3 tons each, and lifting only 2 tons of coal. This did seem rather excessive; and one could quite understand how the inventor would have preferred to have lifted 5 tons of coal with such heavy machinery.

Mr. J. L. CHAPMAN (Harrow), referring to the Monier arches which Mr. Marshall brought before the Institution a year or two ago, said he had the pleasure of seeing them in use, and was struck with the extremely beautiful construction of the work that Mr. Marshall had carried out at Copenhagen. He was sure it would repay anyone who would take the trouble to visit the works. This mode of construction had answered perfectly in places where it had been put already; and though at the last meeting when Mr. Marshall spoke about them there was a large amount of criticism, he was glad to see that this had been fully answered by the plans brought forward that day.

Mr. J. TYSOE (East Greenwich) thought the point raised by Mr. Stevenson was worth attention—that there would be great risk run if the coal was stored for any length of time in timber. His own experience in storing large quantities of coal was that it was necessary to keep timber absolutely away from it. Otherwise, if heating took place the timber was bound to catch fire. He had several times had experience of timber at the bottom of stores being made with openings, in order to prevent spontaneous combustion. But unfortunately it had the reverse effect, as it let the air get into the centre; and when heating did take place, the access of air contributed to the disastrous effect. When a mass of coal was found to be heated at the bottom, and they dug down to it, they found a great part of the timber consumed, and the rest charred.

The PRESIDENT asked Mr. Tysoe what was the cost of discharging steamers at the wharf at East Greenwich.

Mr. TYSOE said the total cost, including repair and maintenance, was about 6d. a ton, which included taking the coal into the stores, about 300 yards from the jetty, and also wear and tear and fuel. He might also say, in reference to the statement made in the paper that 650 tons were discharged in eight hours, that at East Greenwich they unloaded about 1100 tons in eight hours by means of hydraulic cranes, with three gangs of eight men each in the hold; the total number of men employed being 38.

The PRESIDENT did not think Mr. Marshall need regard the lack of discussion on his paper as any indication of want of interest. It would well repay attention—especially by those who had works in hand or in prospect for the conveyance of coal. He had asked the cost of discharging coal from ships at important works on the Thames because, while he was quite sure Mr. Marshall did not desire to magnify the advantages of this particular system by anything like an unfair comparison, yet the comparison he had made was with work done by hand-cranes—a system which might be said to be obsolete where anything like considerable quantities were dealt with. Going back some twenty years, he (Mr. Marshall) would remember that coals were discharged from barges at Vauxhall for 4½d. per ton, though without any provision for wear and tear of apparatus. This was done by steam-cranes, and afterwards more economically still by means of hydraulic cranes.

Mr. G. LIVESEY asked how the large 2-ton grab worked when the ship was nearly empty. He could understand getting a great thing like this into a big heap of coal; but when it got into the bottom of the ship, it would be different. In reply to the President, he said they used the ordinary type of grab for 10 or 15 cwt.; but they were now substituting a more powerful crane. They were using grabs, but not to anything like the extent that the Chartered Company were.

Mr. C. C. CARPENTER (Vauxhall) said, as far as he could see from the drawing, the shape of the steam-shovel differed from that of a grab. He rather gathered there were four shovels, similar to "breaking down" or point shovels, working to a point at the bottom of the apparatus.

Mr. MARSHALL, in reply, said it was a fact that all ships entering the port must contribute 8d. a ton towards the cost of unloading; and this was where they hoped to get their returns from. They would not put down £55,000 without expecting to get good interest for it. Mr. Petersen, at the Copenhagen Gas-Works, was handling his coal for nothing, and putting money into his pocket by it. With regard to the timber, all the coal pockets in America were built of timber; and there had not been a case yet of it catching fire. The reason timber was adopted was because they could easily empty the coal-stores in five or six minutes; and each pocket was furnished with thermometers going into the tip each day. On the first sign of warming, the shoots were opened; and down came all the coal. It could then be spread out and taken away, or put

into another pocket. If iron were employed, they were afraid that, with low heating, there would be a tendency to force the sides of the building out. They could heat woodwork up to a dangerous point without expanding so as to endanger the building; but ironwork could not be heated up to a very low grade without having a serious effect on the homogeneity of the structure. For this reason they decided on wood, and also because it was much cheaper. It was only rough timber, which was obtained close at hand; whereas ironwork would be very costly. With regard to the Monier arches, they must be seen to be appreciated. They stood the test well on the coal-store put up at the gas-works. They could not flatten out; and as long as they could not flatten out, they could not break. At East Greenwich, he understood they paid 6d. a ton for unloading. Before they entered on this contract, engineers were sent to every large coal unloading place in the kingdom—including Liverpool and Manchester—to spy out the nakedness of the land; and they came back and said it was a very naked land—that they were a very long way behind. Then they went to America, and found they could absolutely put their coal into the stores at 2½d. a ton. They knew what Mr. Petersen did at his works with his rough machinery; and he was sure they would be able to put coal from the ship into the store at less than 2½d. a ton. He had been very liberal in his figures; and he felt certain that, if he had the pleasure of coming before them another year, he should be able to tell them they were putting the coal into the store at less than 2d. a ton.

The PRESIDENT said he should like to remark that, in this as in his previous papers, Mr. Marshall set an excellent example of the method in which a paper should be prepared. The care with which the diagrams had been got up, and the illustrations, both of the work itself and of kindred work, prepared, was worthy of thanks and imitation. If papers were put in hand early, such illustrations could be provided without very much trouble.

ANOTHER STEP IN PROMOTING THE UNION OF CAPITAL AND LABOUR.

By GEORGE LIVESEY.

The boundless good nature of the members of the Institution, must surely be taxed to listen to a third paper within six years on one subject from the same individual. A profound conviction of the unsatisfactory and unstable conditions now in existence, the great importance of the question, and the necessity for active and earnest remedial measures, must be the justification for again bringing it forward. The only excuse for silence and for doing nothing, would be the feeling that nothing can be done. This would be a counsel of despair; it is groundless and unworthy of any man who has the welfare of his business and his country at heart.

In 1892, a paper on "Profit-Sharing" was read, and in 1894 another on "The Relations of Capital and Labour in Gas-Works." In both, measures for identifying the interests of employers and employed were advocated and explained. Since then, matters have not improved, but have become distinctly worse. Strikes and threats of strikes of gas workers have again become prevalent, with the result that in some places the management has lost control; in others, the fight has ended in the defeat of the strikers; and in others, again, there is a feeling of unrest, shown in unreasonable demands on the part of the men, and uncertainty as to the future on that of the management, that must be detrimental to the business in which both are interested and by which they live. In common with all good and useful objects, the union of capital and labour in any degree cannot be attained without well-directed effort, especially on the part of employers. If nothing be done, time will not effect a cure. The effect of time is destructive; and unless counteracted, the forces of destruction necessarily result in ruin and decay. Applied to the subject under discussion, the forces of mischief and erroneous doctrines, if left alone, can only result in still further separating labour from capital, to the great injury, and, if the process remains unchecked, to the ruin of both.

What is the present position? The Gas Workers' Union have been true to the policy set forth in a speech at Plymouth, where their Secretary—referring to the South Metropolitan strikers—said, on Feb. 15, 1890, that "the men would not give seven days' notice again before striking." On the evening of the Friday before last Christmas, the men left their work at a certain gas-works without any notice whatever, with the result that the company accepted the Union terms in every particular; and they did the same at Leeds on Thursday, April 22. It is true that in some other cases a week's notice has been given, as at Derby; and when the Company asked for, and expected, a few days' extra time for further consideration, it was refused, and the men came out in the hope that the Company would be forced thereby to give way—but happily in vain. Gas directors and managers all over the country owe a debt of gratitude to their friends at Derby—and especially Mr. Taylor—for the successful stand they have made this year against the tyranny of the Gas Workers' Union.

These cases are simply types of the action the Union is taking. They show the anxious position of those on whom rests the heavy responsibility of maintaining unbroken the supply of gas, on which the public safety—to say nothing of its convenience—so largely depends. The regular supply of gas is so important and so necessary, that it ought not to be possible for any irresponsible body, such as a Trade Union, to have any power of interference. In short, the men who take service in a gas undertaking should surrender the right to strike. Parliament has, in the Conspiracy and Protection of Property Act, made it a penal offence for the employees of gas and water undertakings to break a contract of service, and thereby endanger the supply of gas or water. It therefore only remains for gas managers to make such contracts with their men as will secure immunity from such a contingency.

In the case of an important gas company in Yorkshire, a contract has been for many years made with the stokers in August for eight months—now extended to the whole year. In other cases, contracts or agreements are made for periods varying from a minimum of three months in the case of winter men, to twelve months for the regulars. These agreements are made at any and all times, and consequently expire at different dates; therefore the men cannot all leave at one and the same time. The men, so far from objecting to the agreements, are most anxious to sign, for the very sufficient reason that they are thereby relieved from anxiety as to their employment; and in many cases there is no doubt they are glad of the protection the agreement gives them against attempts to make them leave their work. A man can then say: "I have signed an agreement; and therefore I cannot strike."

In some cases, the agreements confer no other privilege; in others, a bonus of a shilling is given for each week of the term of the agreement, payable on its expiry; and in the case of the South Metropolitan and Crystal Palace District Gas Companies, where profit-sharing has been adopted, participation is made conditional on signing an agreement. It seems fair and reasonable that, in consideration of the security the agreements give against a strike, there should be some additional advantage granted to the men. These agreements may be regarded as the *first step* in the union of capital and labour. They give on one side security of employment; and on the other security against a strike. But there is the great defect that they create no identity of interest between employer and employed. They are simply a legal bond of union into which both parties are willing to enter for the advantages they respectively obtain; and so far as they go, they work well.

The *second step* is a great advance—lifting the workman to a higher level, and giving him a direct pecuniary interest in promoting the welfare of the business by which he lives. This must be right; the only question being the selection of the best method. In the case of gas companies, the method was indicated more than twenty years ago, and only needs extension to the employees. It would be absurd, with an available workable system in existence, to complicate the question by introducing something different unless decidedly better. Nothing better having been proposed, the principle of the sliding-scale holds the field. So long ago as 1882, our late much respected and lamented friend Mr. Travers, of Cork, read a paper on the subject, in which he said the author of the sliding-scale had "only performed half the work when he settled a sliding-scale for the benefit of the consumers and the proprietors, and omitted the workers, on whom the labour devolved of making it a success. If its cheering influence were felt inside as well as outside the gas-works, you would then, to my mind, have a most perfect form of co-operation. I

would include every one in the staff, down to the youngest boy." This impeachment was admitted; and seven years later, the extension of the principle of the sliding-scale was made to all the employees of a Gas Company, from the highest to the lowest, who cared to accept it in the form of profit-sharing then adopted, and which has already been more than once advocated before this Institution.

Thus was step number two taken with satisfactory results; but "mere profit-sharing does not go far enough, it is only a half-way house to a complete identity of interest between employers and employed." On this quotation from a published letter of mine, the "Shipping World" of March 24 last remarked: "Profit-sharing is commendable. But it stops half-way between a pension (or an annual bonus) and a partnership. But to make the worker a shareholder in the works, a partner in the adventure, is to immensely enhance his value as a workman. The success of the works would be to him a matter of profit and of pride. He would desire to faithfully serve the enterprise, in which he had an interest deeper and stronger than that of a wage earner. He would be concerned to know that everyone did his duty. The workpeople would become a community of people whose interest it was to see that all did their best. Under such a system, with capable and trusted workmen on the directorate or direction, strikes would become rare and well-nigh impossible; for it would be of advantage to every man, as it would of benefit to the establishment and the country, to avoid all disputes that might militate against commercial success." It will be some time before this admirable picture is realized in practice. Both employers and employed need educating. But the argument is sound; and that being so, its fulfilment may be expected if men will work for it.

The above quotation indicates the nature of the *third step* towards the union of capital and labour referred to in the title of this paper. When profit-sharing was started, two of the workmen expressed the hope that facilities would be given to become shareholders. The hint was taken; and employees equally with consumers were enabled to purchase small amounts of stock at the market price. In four years up to the end of 1893, the amount invested by employees was £4281—an average, say, of £1000 a year.

In 1894, the rate of the profit-sharing bonus was increased from 1 to 1½ per cent. on salaries and wages for each penny reduction in the price of gas, on condition that one-half of each man's annual bonus should be invested in the Company's ordinary stock. This was accepted, with the result that the total money investment at the end of each year has been as follows: December, 1893, £4281; 1894, £17,641; 1895, £25,642; and 1896, £46,079. This new departure gave a great impulse to investment. The half bonus to be invested amounted to about £21,000; but there was an increase of nearly £42,000 in the three years. The figures speak for themselves more eloquently than anything that can be said in their favour. An interesting fact, giving stability to the holding, is the union of the names of husband and wife as shareholders in a large proportion of cases. Moreover, there have been scarcely any sales. Before this year expires, nearly all the officers and workmen will have stock in their own names. The stock can only be purchased in amounts of £5—worth £7 in money. Consequently all smaller sums are invested in the aggregate in the names of three trustees, until each holding becomes, by the annual or other additions, sufficient to be registered in the name of the individual owner.

I have long cherished the idea that the well-being of the Company would be greatly promoted if employees of all ranks could be induced to become shareholders; but it always seemed so far beyond the range of practical politics, that even to consider the question was regarded as a dream that never could be realized. It has now become an accomplished fact; and there is no reason to doubt that it will continue to grow indefinitely. If so, it will surely lead to a fourth and final step, which will, if successful, complete the series. Or if, after fair trial, it should fail, the object must be pursued on other lines, and the work taken up by other and more capable hands. The steps or gradations may be summarized thus:—

1.—Agreements, forming a legal bond of union only.
2.—Profit-sharing, creating a union of interests.
3.—Shareholding, or partnership in the profits and risks.

These three steps should, where possible, all be combined. The Crystal Palace District Gas Company did so successfully at the start of profit-sharing in 1894. The South Metropolitan started profit-sharing in 1889, which grew into shareholding in 1894.

4.—Partnership in the responsibility of control and management.

It cannot be expected that so large and compact a body of shareholders as the entire staff of officers and workmen of the South Metropolitan Company—numbering nearly 3000, and holding in the aggregate (as seems highly probable at no distant date) a very large amount of the capital of the Company—will permanently rest content with outrepresentation on the Board. It is true that at present their united holding (if the invested amount alone is considered) is insufficient to support such a claim. But the investment is growing fast; and the desire of all parties is unanimous that it should continue to grow. These being the facts, it is infinitely better to anticipate the inevitable, to prepare for and to make the necessary provisions for meeting it, than to wait until one's hands are forced—in short, to lead rather than be driven. On this ground, the proposal now authorized by Parliament was made, that the employee shareholders should, on the fulfilment of certain specified conditions, be empowered to elect Directors to sit on the Board. One condition was that the aggregate holding of ordinary stock should exceed £40,000. This point was reached last year—two or three years sooner than was expected—and the investment will be largely increased next July. The experiment must, therefore, shortly be tried, when success or failure will depend on the selection made by the shareholding workmen.

If the new Director or Directors can, and will, rise to the position, regarding it as their duty, like that of the other Directors, to make the general welfare of the Company their chief object, to endeavour to do equal justice to all who do business with the Company, to the consumers, to shareholders, and employees, good must result from the movement. On the other hand, if they take a narrow or class view, and persist in it, on them must rest the blame of failure and of putting back and crushing a genuine and sincere effort to unite capital and labour, that would have lifted their class to a higher level in the industrial and social scale, and by its educating effect have better fitted them to exercise their great and responsible duties of citizenship.

The question has often been asked: How can profit-sharing be applied to non-sliding scale gas companies, and to corporation gas undertakings? The reply is: Just as easily, and in exactly the same way, as it has been adopted by sliding-scale companies. The schemes in force at the South Metropolitan and the Crystal Palace District Gas Companies, although based on the principle, have no connection with the sliding-scales in the Acts of those Companies. Those profit-sharing schemes could, with equal ease, have been adopted had the Companies been under the old system of legislation. The initial prices for the profit-sharing are not the same as those fixed by Parliament in either case; neither are the increments of profit the same. The only similarity is in the principle of making the bonus, like the dividend, vary for each penny variation in the price of gas.

The South Metropolitan initial price fixed in the Act is 3s. 6d., the Directors fixed 2s. 8d. per 1000 cubic feet for the purpose of calculating the profit-sharing bonus. The Acts of Parliament usually authorize a variation of ¼ per cent. in the dividend per penny alteration of price. The South Metropolitan profit-sharing scheme gives 1½ per cent. up to a certain point, and then 1 per cent., bonus on salaries and wages per penny; while the Crystal Palace District gives 1 per cent. up to 6 per cent., and then ½ per cent. per penny in the price of gas on salaries and wages. The initial price should be fixed at a figure that will, to begin with, give a bonus of 3 per cent., of which half should be invested in stock, and only the other half withdrawable. Workmen are quite willing to start on these terms, with the hope of more as the price of gas falls. The only difference between gas companies and corporation undertakings lies, not in the adoption of the system of agreements or of profit-sharing, but in taking the third step which makes the employees shareholders in the concern; and here corporations are certainly at a disadvantage, which is an additional reason against their ownership of gas-works,

There is also a difficulty, but one easily overcome, in the fact that corporations are often more desirous of relieving the rates than of reducing the price of gas. If the system of subsidizing the rates is to be permitted (I cannot say justified), corporations, in common with the companies, should be put under the sliding-scale; the subsidy to the rates being made, similarly to the dividends, dependent on the price of gas. The employees would naturally say, in many cases, if profit-sharing were introduced: "You ought to sell gas cheaper, and could do so if you did not take gas profits to help the rates." The point can be met by calculating the equivalent in pence per 1000 cubic feet of the amount paid year by year to the rate fund. Suppose a corporation gas-works with a profit-sharing system on sliding-scale lines in operation. The initial price fixed for the purpose is (say) 2s. 9d., and the selling price 2s. 6d. per 1000 cubic feet; and the amount in aid of rates equals (say) 2d. per 1000 feet. In such a case, the price of gas for the purpose of calculating the profit-sharing bonus would be reckoned as 2s. 4d., which would give a bonus of 5 per cent. on salaries and wages, if 1 per cent. per penny were the scale adopted. There would certainly be an additional—but even then no insuperable—difficulty in dealing with such a case as one to be found in Field's Tables for 1895, where 7·32d. per 1000 cubic feet is taken from the consumers to reduce the rates. There is, however, little probability of such a corporation adopting profit-sharing. It would no doubt be a check on such action, and would probably be beneficial all round.

The old relations between employers and employed, based on personal knowledge and friendship, are a thing of the past, though, happily, sympathy can still be manifested. The old relationship cannot be restored by the granting of a privilege here or a favour there, by outings, and beanfeasts, and suppers, even where these are practicable. Workmen will, of course, take these things, and will sing, on occasion, of the giver: "For he's a jolly good fellow;" and then on the call of outsiders—or without it—will strike against him without the slightest compunction. This is but human nature, based on self-interest. Kind feeling and friendly sentiments on the part of the employer, while good in their way, will not alone keep his workmen loyal. Their association is one of business only; and business is and must be governed by self-interest, not by philanthropy or that new-fangled, and rather difficult to understand, Socialist word—"altruism." Therefore the only sure and certain bond of union of employers and employed must be mutual self-interest, founded upon just dealing.

On this foundation, sympathetically laid, add as much friendly interest and other good things as possible. They will certainly help to promote satisfactory results; but, standing alone, little dependence can be placed upon them. Moreover, the best means an employer can adopt to prove his goodwill towards his workmen, is to show his desire for their prosperity by taking the lead in arrangements for improving their position; and one of the best is to make his interest and theirs identical. In all movements of the kind, the lead must be taken by the employer. His right place is that of leader; he abdicates it at his peril.

The question may be asked: Why do this? Cannot we leave it alone? It has been left alone, with the result already stated. The answer is: Because a cheerful and contented spirit will pervade the great body of the workmen, which produces good work, and besides its money value, gives peace of mind to the management, and is a great factor in the satisfactory working of the concern. Further, mutual interest begets confidence, and thus kills the mutual distrust now so prevalent; and strikes become practically impossible.

Appended is a copy of a form of agreement. If profit-sharing is added, as it should be, the Secretaries of the South Metropolitan or the Crystal Palace District Gas Companies will give copies of agreements, rules, and every information. It may be added, in explanation, that clause 2 is inserted to meet the case of those men who are stokers in the winter, and barrowmen, yard labourers, mainlayers, or bricklayers in the summer. It may also be stated that the consent referred to in the last paragraph is always given, because any man can be spared at any time; but if a large number of men wished to leave at the same time, to the detriment of the Company, consent would, of course, be refused.

APPENDIX.

Wages No.	Profit-Sharing No.

General Agreement.

MEMORANDUM OF AN AGREEMENT made the day of 189 between for and on behalf of the Gas Company, of , in the County of , of the one part, and , of the other part.

1.—The said for the Gas Company agrees to employ the said for a period of months from the day of the date hereof, if he shall remain sober, honest, industrious, and able to do the work allotted to him.

2.—The said agrees to serve the said Company for the said period of months in whatever capacity he may from time to time be employed by the said Company, at the current rate of wages applying to such capacity.

3.—The said agrees to obey the orders of the Foreman in charge.

4.—The Company undertake that, during the continuance of this Agreement, the different rates of wages in force at the date hereof, and which, under Clause 2, may become payable to the said shall not be reduced.

As WITNESS the hands of the parties,

No obstacle will be thrown in the way of any man engaged under the above Contract who may wish to leave the Company's employment before the expiration of the period of service therein agreed for provided he shall notify such wish to the Engineer; and on receipt of such notice, the Engineer shall, in his discretion, consider whether the services of such man can be dispensed with without detriment to the Company, and, if so, permission will be given at the expiration of the usual week's notice.

It occurred to me that it would be well to get the opinions of the workmen, because it was all very well for me, and for the officers of the Company, to say this and that about the scheme; but it might be asked: "What do the other side say about it?" I therefore invited the shareholding workmen to give me their opinion on the subject. I have some hundreds of their letters; and I must say that I am exceedingly pleased with them. They are evidently honest expressions of the men's opinions; and they are uniformly in favour of the system—speaking in very high terms of its benefits, both to employers and employed. In a great number of the letters, they speak of the union between capital and labour; and they say that they know nothing so well calculated to promote the union—which they recognize as necessary—as this system of profit-sharing, developed into share-holding, which we have adopted. There is another thing which has pleased me very much; they are not selfish. Over and over again do these men say: "We wish it could be applied to other concerns. We wish other firms would adopt it." One of them writes: "I hope you will be able to convert a good many of the gentlemen to whom you read your paper." They are so satisfied of the thing being a beneficial one that they do not wish to keep it to themselves. I have in my hand a number of these replies. One man says that it has enabled him to save money: "I have many times tried to save money and failed. But after having partaken of the benefits and other advantages offered to the men, I commenced to have a little, which I left in every week, with the result that I have now £35 of stock" [that is about £50 of money] "in four years." Here is a letter I must read: "Dear Sir,—I must say we" [that is himself and his wife] "have derived great benefit from your profit-sharing system, and think it is one of the best methods ever started to bring masters and men together. My wife and I both agree about that. Eight years ago, we had not got a penny saved; but we have never drawn a farthing of our bonus, and have added considerably to it. Besides that, we leave 2s. a week for savings; and we are proud and happy to say we have accumulated enough to buy a £100 share" [that is £140] "after eight years. I am only a carman, and have a family to support. We only hope and trust it will continue, as we want to have something laid up for our old age. Having derived so much benefit ourselves, we should be extremely pleased to see it adopted in every firm throughout the country; and that is our true and honest opinion." I think a letter of this sort—and there is honesty on the face of it—is really very encouraging; and no one can say that this carman, now that he has accumulated £140, is

not a better servant of the Company than in the days when he could not save a penny.

Discussion.

The PRESIDENT said the subject which Mr. Livesey had introduced was one dealing so much with questions of policy, that some members might feel they were not called upon—even if they were justified—to express any very decided opinion upon it. But this was not so with all; and he hoped to have the views of some of those present as to the possibility of further extending the system with which Mr. Livesey had identified himself. For himself, he should like to say that personally he had no desire to see unions of workmen made less powerful than they were. He believed cordially, not only in the right, but in the desirability, of combinations of workmen, in order to secure and advance their own interests and influence. But one could not but recognize that Unions, as they knew them, had so far been conducted on lines so narrow, and at the same time so ambitious, that their influence had been distinctly injurious. That they should expect men would continue to act as individual units, while employers had many means of combination, was unreasonable, and certainly from the point of view indicated by Mr. Livesey undesirable. No scheme of co-partnery or otherwise could be of value unless accepted practically by the united body of workmen. If Unions were directed to improving the condition of the men, by enabling them to secure fair wages for good work, provide against sickness and failing strength, no one could do other than wish them well. He saw no difficulty about the continuance of such combinations as the system which Mr. Livesey had introduced with such success in his own Company; the men retaining full liberty of action, while bound by the strongest ties to their employment. He was very much surprised—seeing how conspicuously successful this departure had been with the South Metropolitan and Crystal Palace Companies—that it had not had a wider adoption. He could only suppose this was caused by the state of peace generally prevailing. The relations between the men and the engineers and employers had been, on the whole, fairly pleasant and agreeable; and there was not a disposition to disturb that which was working fairly well, until some strong disturbance—such as a strike—proved that the peace was but a temporary truce, and not based on mutual interest and content. He thought it was very undesirable that this should be so. It was infinitely better, while matters were going on pleasantly, that there should be an effort put forward to strengthen the relations of employers and men.

Mr. HOLGATE said he was sorry he was unable to add anything of interest on this important subject; but he heartily congratulated Mr. George Livesey on the work he had done in this direction. He had not had an opportunity of following on the lines he had indicated; but if it presented itself, he should be delighted to put the plan into operation, and should take the opportunity of bringing it before his Committee. He thought sufficient experience had now been gained to have removed any suspicion which might have lingered about it at the commencement. No doubt a large number of the workmen viewed it as an attempt at curtailing their power. But they must be convinced now that the motives of the promoters of the plan were disinterested; and that the plan was calculated to do the utmost good to the workers themselves.

The PRESIDENT asked Herr Körting if, in his experience of German workmen, there was any parallel to these arrangements.

Herr KÖRTING said nothing of the kind had been done in Germany. But they had tried various means of getting into a better condition with the workmen—by making provision for accidents, sickness, and so on. The old men did not get a large sum; but they were entitled, after their seventieth year, to an income of 150 marks. All these things contributed to making the arrangements between employers and workmen better; but in the particular direction referred to in the paper nothing had up to the present time been done.

Mr. W. FOULIS (Glasgow) was certain they must all appreciate Mr. Livesey's desire to better the condition of his workmen, and wish as far as possible to follow in his footsteps. In reading the paper, however, he felt that something more than Mr. Livesey indicated was necessary to elevate working men. Of course, if they had been all Scotchmen they might have considered that the mere fact of putting money into their pockets was quite sufficient to elevate them to any point; but he did think something more than this was required. While they might not be able—as those connected with corporations were not—to make arrangements so that the men could share in the profits of the undertaking (because they were supposed to work at no profit at all, which was a great mistake), there was something beyond this. He often thought that if a man were put on for eight or twelve hours a day to draw out hot-coke barrows from the retort-house, no amount of money would raise that man—his whole occupation was to a certain extent degrading; and what he (Mr. Foulis) thought was that they would probably do more to elevate the workmen by rendering their brute force unnecessary—making the men more intelligent men, and giving them more mental interest in their work. Let the men occupy their minds as well as their muscles; and in every way they would have a better class of men to deal with. Throughout the works at Glasgow, they had been striving to do this more and more every year; and he could only say they had now a better class of men about than ever before. With regard to the agreements, one of which Mr. Livesey had kindly sent him, all the best men at Glasgow were signed on for two, three, six, or twelve months. They could not give them a share of the profits; but they did give them 1s. a week bonus, provided they served their time with satisfaction. This method had proved exceedingly satisfactory, not only to the employers, but also to the workmen themselves.

Mr. FRANK LIVESEY (London) said his experience had been that this scheme was greatly to the benefit of the Company he represented. He could not quite take Mr. Foulis's view that heavy labour must be degrading. There were some men wheeling out barrows of coke who, if not fit to be Directors, certainly had intelligence; and this scheme had added to their intelligence, and given them an incentive to study the matter. It could not be expected that every man who had £5 of stock was going to consider the Company's interest as much as his own; it was not human nature. But still they did find that there were a large number of men scattered among the others who acted as a sort of centre of instruction; and the interest was increasing year by year, for whereas at first only a few took an interest in it, now a very large number did so. Of course, there were some men who would never go beyond looking at it as a money-saving system. But the great benefit of the scheme was this—that the spirit of antagonism had altogether left the men. The spirit of the Trades Unions, for instance—when the bricklayer must only lay so many bricks, and the riveter must only put in so many rivets per day—had gone; and the same principle came in with regard to filling scoops of coal. Of course, the Trade Unionist would say: "Oh! but your idea is to get the men more under your control." The answer to this was that the men, by means of their Profit-Sharing Committee, could discuss any matter they liked to bring up, and it would be settled in a friendly way. Four steps had been mentioned in the paper. With the first three of these he heartily agreed, but not with the Workman-Director. The workmen were not yet educated up to such a position, or not sufficiently so to allow of their sending any one of their number to take part in the management of the Company's business. There were some men who might be of use in the Board-room; but how could their election be ensured? There were others who would be a hindrance. He hoped some one else would try the profit-sharing system, besides the two Companies mentioned, because he was sure it would be a benefit all round. The companies would lose nothing, but gain a great deal, because they would be on better terms with the men, who would do more work, and in a more satisfactory manner. In fact, the anxiety about labour troubles would vanish.

Mr. MARSHALL was afraid that putting workmen on the Board was rather a Utopian scheme. He asked Mr. Livesey what would be the function of the new man, when he arrived in the Board-room.

Mr. LIVESEY: He would take his part with the other Directors.

Mr. MARSHALL said it seemed to him that before long all the Directors would be working in the retort-house, and all the retort-house men would be sitting on the Board. Speaking seriously, he desired to ask whether these men's

powers would be limited, or would they take part in all discussions appertaining to the Company?

Mr. H. H. SALOMONS asked if the profit-sharing scheme was limited to the workmen only.

Mr. LIVESEY said no. It was open to everybody, including the clerical staff—to everybody but the "unfortunate" Directors.

Mr. F. BUSH (London) said it had been remarked that no big question was ever discussed in public without some wild speech; and if the principle was sound, it did not suffer from the silliness of its supporters. He ventured to say they had had no wild speeches that day, but had heard a calm and temperate paper from Mr. Livesey; and he did not think anyone could stigmatize them as silly because they happened to be followers. The only question was whether the principle was sound. They had heard of its annual growth, and of its continuing to grow; and no one could have predicted that the small acorn sown in 1889, would have grown to the fine oak they now saw. Mr. Livesey's only regret must be that he did not in 1886 make the sliding-scale applicable to all the Company's employees as well as to consumers. If he had done so, he (Mr. Bush) believed there would have been no Gas Workers' Union, and he was quite sure there would be no strike at the South Metropolitan Gas Company's works. John Stuart Mill said things went through three stages—ridicule, controversy, and acceptance. Profit-sharing soon came out of the first category; he ventured to think it was emerging from the second; and after the words that had fallen from the President—that he considered it a panacea for strikes—it would not be long before it was accepted by other companies. It necessarily involved a certain amount of trouble; but who would not take the trouble to have a body of loyal and intelligent men under him? At times, some men came up and said they would like to sell their stock. But fortunately joined to the man was the woman; and if the man wanted to go on the spree, they required two signatures to the transfer. There the woman was the sheet-anchor. Again, there were many good objects for which they wished to sell. Quite recently a man came and wanted to buy his son out of the army. Then they advanced it to him. Another man came and said he had lost his boy, and wanted some money. On inquiry by the Engineer, and ascertaining that these statements were true, in many instances, instead of a man selling the stock, they made him an advance of £2 or £3; and to the credit of the men, he should say that in all these cases the money had been returned. On the whole, there were very few sales. Again, he might say that the Inland Revenue Authorities had met them in this matter very fairly. There were a large number of dividends—700 or 800—and the deductions for income-tax were very small. But instead of an elaborate scheme being sent in by each man, the Inland Revenue accepted his certificate. All men who were receiving £2 15s. a week—or £143 a year—were exempt; and they returned *en bloc* the whole of the income-tax, which was refunded to the men. They had recently returned between £50 and £60. In conclusion, if he were now to be asked: "Would you have supported profit-sharing if you had known that it would have brought the appointment of a Working-man Director at the end of it?" his answer would be: "Yes," with this limitation—that he considered £40,000 an insufficient qualification. But who, in 1896, would have said that these men would have, not £40,000, but nearly £80,000.

Mr. C. C. CARPENTER said he might contribute a few words from another point of view—that of one directly connected with the conduct of a gas undertaking, with regard more particularly to the daily management and control of a large body of men. They must not lose sight of the origin of this system of profit-sharing. The Trades Union then in existence was essentially an aggressive one, and showed no disposition to accept any advances made in response to the propositions put forward to bring into amicable relationship employers and employed. The experience of the last few years had shown that, instead of becoming more useful factors under modern conditions of the labour world, they were getting the reverse. They were less useful, and certainly more aggressive. So long as this was the case, he could not share the view expressed by the President; and he felt sure that, unless they took some step to check this by introducing something more to the advantage of the employer and the employed, they would still have with them that persistent trouble which even quite lately had been found an increasing one. The question was, How could this best be done? It must not be forgotten that they had now to deal with men who were to a considerable extent educated. Ten years or so ago, the average stoker might be able to read; but it frequently happened that he could not write. He had direct evidence of this in obtaining signatures to a certain proposal, when he found that a large proportion of the men in the carbonizing department could not write their names. Now it was rare to find a man who was not able to write; and the majority wrote well. With the extension of their education, of which this might be considered an index, they became more thoughtful men; and as more thoughtful men, they probably put the question to themselves which he knew gas engineers themselves sometimes did: "Here am I working very hard. I do not think I am getting as much remuneration for my work as I should do; I ought to have some more direct interest in the prosperity of the undertaking than I have." Gas managers undoubtedly put this question to themselves; and it was not unlikely that working men did the same thing. This fact had to be taken into account. He thought the scheme had been drawn so as to put this proper feeling to good use. The steps had been very clearly stated in the paper. First, an agreement was mutually made, forming a legal bond of union only, to work and be provided with work for stated periods. The second point was profit-sharing, by which the men were given an interest in doing their best, and working with a good will. Seven or eight years ago, it was part of the Trade Union principle that a man should only do an absolute and definite amount of a particular kind of work, according to a set of arbitrarily drawn rules, no matter how circumstances or conditions might vary. But with their present system, they had no difficulty of this kind at all. It did not matter who was asked to do any kind of work, he would see the necessity of it, and would lend a hand cheerfully. The third point was shareholding, and thereby partnership in the profits and risks of the undertaking. The more the system was extended, the better it undoubtedly must be. Gas companies and corporations were conservative enough as it was; and this frequently happened from the geographical isolation both of the works and the manager himself. In some cases, it was more marked than in others. But it had undoubtedly arisen in some instances from the fact that there was not the direct touch there should be between the consumers and the shareholders. If one could give the consumers a direct interest in the undertaking (which they would obtain as shareholders), they were far more disposed to be friendly than otherwise to the management. If this were a good thing—and the question if put to any man of business could but be answered in the affirmative—it certainly followed that the workmen themselves should be attached in the same way. He was daily coming in contact with the men; and he could say that under no circumstances would he go back to the old condition of affairs. At one time, he might have said that to have a committee of workmen, and sit down and discuss matters affecting the conduct of the undertaking, would have been attended with grave difficulties. But it did work, and it worked admirably; and no one who had not had direct experience could understand how easily little difficulties were rectified almost as soon as they appeared. He felt it only right to bear this testimony to a system which had been an absolute success, and had worked admirably in every possible way.

The PRESIDENT said he must ask permission to make a short explanation, because he had clearly said something which had been misunderstood, or it would not have been suggested that he was in any way out of sympathy with the system suggested by Mr. Livesey and practised with such perfect success. What he said was that he thought a system such as this might be worked without any actual antagonism with the principle of Trade Unionism. Whether it was necessary that a Trade Union should exist outside the limits of one employment, he did not say. He did not see any necessity why it should go beyond the limit that would attach to the employers. If employers joined together to regulate wages, the men should be at liberty to combine also, and to an equal extent. This system did provide, in his opinion, one of the very best possible methods of Trade Unionism; and the probability was that, when adopted, it would be found to be sufficient in itself without extension outside the limit of one single factory or undertaking. He believed it would have the

effect of broadening the basis of interest in a man's environment, which would add to his intelligence and his happiness. He had no doubt at all the difficulty had been felt, as was suggested by Mr. Holgate, with regard to the choice of the men to be representatives of the workmen. But he thought the principle which would guide the men in their choice would be very different under such a system to that which had governed them in the unfortunate choice so often made in the old Trade Union. Where they had so many inducements to choose, not the man who would make himself offensive to the employers, but one who would help forward the interests in which they all had a share, the selection was likely to be a much wiser and more prudent one.

Mr. Foulis asked Mr. Livesey if he could give any idea of the percentage which his profit share came to as an increase of the men's income.

Mr. J. Tysoe said at present they were considerably extending the works at East Greenwich; and it was necessary to get in bricklayers who were members of the Union. Within the last few weeks, two men had left—one because he would not work with a labourer who was employed by the Company to lay certain bricks, and another because he refused to lay other than bricks. They had a certain amount of rubbish coming from the retort-settings, which was used instead of bricks; and he refused to do this, and preferred to leave. These men, no doubt, acted in conformity with the rules of their Union; but it only showed the great difficulty of incorporating their system with Trade Unionism.

Mr. George Livesey, in reply, said he was a little disappointed that there had been no sort of adverse criticism, because it would have afforded an opportunity for removing erroneous impressions. However, the probability was that there was no erroneous impression; and this was perhaps better than having to remove it. With reference to the friendly remarks of the President, he must say he considered this system quite incompatible with Trade Unionism. The two things were diametrically opposed. Trade Unions were the Union *versus* the employer; but in their case it was a union *with* the employer, not against him. With very few exceptions—chiefly to be found in the North of England—the idea of the generality of Trades Unions was antagonism to the employer and to capital. If they read the proceedings of the Trade Union Congress from year to year, they would find Trade Unions were dominated by the Socialists. They passed the Socialistic resolution at Norwich two or three years ago, which had never been rescinded; and it stood to this day. They went for the nationalization of land and all the means of production, distribution, and exchange. There was evidently antagonism with capital; and as they were capitalists, or represented capitalists, there could not be any union between such Trade Unionism and capital. He met a gentleman in the street recently connected with one of the great iron-works of Glasgow, who said the feeling of the men there was one of viciousness against their employers. This was the result of Trade Unionism. What they were trying to do was to get a totally different feeling. Instead of viciousness and antagonism, they wanted to obtain a feeling of union and friendship; and he thought they were on their way to secure it. What he contended for was not two unions—not a union of capitalists and a union of workmen—but one union of capital and labour. In this sense, they had created such a Trade Unionism as would be productive of benefit on both sides. The difference between their position and that in Germany, as described by Herr Körting, was that these accident and insurance funds there were compulsory. He did not think that this was calculated to bring master and man together to anything like the same extent as voluntary association. He believed its good effect there was simply because accidentally it did bring them together to some extent. But he should go very much against the compulsory system, though he thought they were going to have something like it. Sir Matthew Ridley said, however, he thought it would lead to mutual associations of employers and employed. He agreed with Mr. Foulis about the better conditions for workmen, though he did not think that hard labour was degrading. Still, he agreed that as far as possible they ought to relieve the men from the hard labour of the retort-house. They were trying to give the workman a different idea of his position. Instead of being in the position of a simple wage-earner, he was to be elevated into that of a partner—which was certainly a great elevation, if he could rise to it. He was glad to hear what his brother had to say about the matter. The fourth step had still to be tried. Whether it would succeed or not, he would not prophesy. But he should try to make it a success; and so, he felt sure, would all the officers of the Company. He could not speak too highly of the cordial and hearty manner in which they had all gone into the matter so far, and greatly assisted in making it a success; and he quite expected that, with regard to Workmen-Directors, they would do what they could to make that succeed also. In reply to Mr. Marshall's question he did not think it would be right or wise to restrict the Workman-Director in any way. If he had the capacity, let him take his position at the Board table with the others. He was not going to say anything about his own Board, except to speak well of them; but he was quite certain there were many men sitting on boards of direction who were inferior to many workmen he could select, and did great mischief on these boards. What he said in the paper was that, if the workmen representatives took a narrow or class view, and persisted in it, on them must rest the blame of failure. Mr. Bush thought the system should have been introduced with the sliding-scale in 1876. He agreed with him; and he tried to do so, but failed. The sliding-scale, as Mr. Travers said, was incomplete; but now they had tried to complete it. The amount of money in the hands of the Company in stock and on deposit was well over £80,000, as the result of seven years' work. There were 700 or 800 employee shareholders; and before this year was out, there would be some 2500 servants of the Company shareholders. The bonus on wages and salaries last year was 7½ per cent. and it would be the same this year. He thanked the members for their patient hearing. He had brought the matter forward simply and solely because he thought it was a good thing all round; and he wished every undertaking in the kingdom to be as happy in their relations with their workpeople as those he had described.

THE AMSTERDAM GAS-WORKS.

By Henry H. Salomons.

The Institution of Gas Engineers having intimated through the Council their desire to pay a visit to Amsterdam this autumn, the author has thought it would be of interest to bring before this meeting a description of the works which he trusts he will have the pleasure of showing to a considerable number of the members.

Amsterdam had been lighted by the Imperial Continental Gas Association, under the name of the Amsterdamsche Pyp Gas Compagnie (this being the title of the native Company taken over by the Association), from 1834 up to 1845 exclusively; and from that date in competition with a new native company. In 1883, the exclusive lighting of the town was put up to public tender; and that of the Association was accepted. The Company undertook thereby a task of considerable magnitude. The concession was granted them on July 25, 1883, and by Nov. 1, 1885, gas had to be supplied to all the customers of the Dutch Company. This necessitated the building of large works for the supply of about 3½ million cubic feet per diem; the laying of a complicated system of mains throughout the whole city, to the length of some 147 miles, including the placing of some 40 mains under the canals; the crossing of some 172 bridges; the laying of some 11,000 services in wooden troughs filled with pitch; and the placing of some 10,000 meters and 5000 lamp-posts. The distribution work was successfully carried out by the firm of Messrs. John Aird and Sons, notwithstanding the treacherous soil of Amsterdam, and the necessity to keep clear of a double set of existing mains and services. In spite of all these difficulties gas was supplied on Nov. 1, 1885; and by the middle of 1887, the second works were completed. The old works and mains of the Association were put out of action in March of the latter year.

The Haarlemmerweg works (those first constructed) occupy an area of 14·5 hectares, equivalent to nearly 36 acres. The land being at the "polder" level, the greater part had to be filled up with sand to a height of nearly 8 feet. All the buildings rest on piles, as also the mains and connections. Some 25,000 piles were thus employed;

varying from 32½ to 42 feet in length, of which 4448 are under the gasholder tanks, and 1154 under the brick piers of the railway viaduct. For the buildings, 17,180,000 bricks were employed, and 4500 tons of iron; and for paving, 3,242,000 hard bricks, and 4900 square yards of paving-stones. The drains have a total length of some 2900 yards. The first piles were driven on Aug. 8, 1883; and on Jan. 1, 1885, all the buildings were completed, excepting the dwelling-houses, offices, and workshops.

The works, which can be used separately in two sections, are bounded on one side by the railway, and on the other by a canal, along which runs a stone quay some 730 yards long. There is a high and low level line. The former enters the works by means of an iron viaduct supported on brick piers, which branches off right and left into the two sides of the stage retort-houses. In the latter, the lines are carried upon wrought-iron girders and columns, at a height of 13 feet above the stoking-floors. The coal is stored under the viaducts, and in front thereof. In the coal-stores placed on one side of the retort-house, two lines also run, carried on wrought-iron viaducts connected with the lines entering the retort-houses by means of a traverser. On the coke-floors of the retort-houses are laid tram-lines of 30-inch gauge, running to the canal for the purpose of loading barges; all the coke from these works being taken away by water. Tram-lines also run to the coke heaps, to the breakers, and to the different buildings. Between the two retort-houses are placed the mess-rooms and bath-rooms for the stokers and foremen. In front of each retort-house are galvanized iron buildings, in which are the coke-breakers, worked by 5-horse power steam-engines, separated from the former by glass partitions. The coke is raised by means of a "Jacob's ladder," and broken and screened.

No. 1 retort-house is 297 feet long and 112 ft. 6 in. broad, and contains in a line back to back 32 benches in blocks of eight; space being left for the construction of a further eight benches. Of the 32 benches already built, 16 are regenerators with nine retorts—eight of the Hasse-Didier, and eight of the Munchener system—the remainder are fire-bar benches with seven retorts, but built on arches so as to be easily convertible into regenerators.

No. 2 retort-house is 291 feet long, and also 112 ft. 6 in. broad. It is built for, and contains, back to back, 40 benches in blocks of ten. Of these, ten are regenerators on the Munchener system with nine retorts; and the remainder fire-bar benches with seven retorts, constructed in a manner similar to those of retort-house No. 1. The hydraulic mains are of wrought iron ⊔ shape, 2 feet by 2 feet, placed on the top of the benches. The mains of each block of benches are separate, and have at each end 9-inch outlets, which descend through the stoking-floor under the arches of the coke-vaults to separators outside, from which the tar and ammoniacal liquor flow into separate wooden tanks sunk into the ground. By means of steam-pumps placed in the basement of the retort-houses, the contents can be pumped therefrom into tar-tanks on the banks of the canal, or into the liquor-tank in the water-tower. The gas rises from the separators through vertical pipes to cooling-mains placed outside the whole length of the retort-houses, and from which the gas passes through two 30-inch wrought-iron mains, placed upon columns, across the yard to the condensers.

Between the high-level railway and the retort-house is placed a coal store or shed, composed of wrought-iron columns and roof with galvanized iron covering. This store is 180 ft. 6 in. long, 105 feet broad, and 24 ft. 6 in. high; and can contain 8500 tons of coal. Two railway lines run on iron viaducts through the whole length. Following this store, and of the same length but half the breadth, is another of the same construction, used as a general store, but arranged so as to be capable of being doubled in breadth and converted into a coal-store by prolonging the railway viaducts through it. The annular condensers, supplied by Messrs. R. Dempster and Sons, consist of two batteries, one of 13, the other of 14 upright columns, 50 feet high, 4 feet outside diameter, and 3 ft. 6 in. inside. From the condensers, the gas passes to the exhausters, three in number, supplied by Messrs. Gwynne and Co., coupled directly to 16-horse power steam-engines, and each made to pass 80,000 cubic feet per hour. These are placed in a room 43 feet by 36 feet, with space for a fourth exhauster and the engine, for which the foundations are prepared. In an adjoining building are three Pelouze and Audouin condensers, for entirely freeing the gas from tar before it enters the scrubbers. Next to the Pelouze condensers or tar-extractors is the pump-room, in which are fixed eight direct working Evans steam-pumps in duplicate, for pumping water from the canal, tar, ammoniacal liquor, and for the service of the scrubbers. In the same building are placed four Cornish boilers, each with a heating surface of about 215 square feet, arranged to be fired with coke or by means of breeze with a forced draught.

The scrubbers are three in number, and were supplied by Messrs. R. Dempster and Sons, of Elland; and foundations are prepared for a fourth. They are 65 feet high and 12 feet in diameter, and filled with boards set on edge, placed in cross tiers. Fresh water is admitted at the top, and weak ammoniacal liquor at mid height.

There are two purifying-houses, consisting of basements and upper floors, upon which are placed the purifiers supported upon rolled joists and wrought-iron columns. The height of the upper floor from the basement is 6 ft. 7 in. The purifiers were supplied by the firm of Messrs. C. & W. Walker, and consist of four sets, two in each house; each set comprising eight boxes, 20 feet square and 5 feet deep, with five tiers of grids.

The centre-valves and connections are situated in the basement, and thus easily accessible. The houses have wooden roofs covered with tiles, and with ventilating louvres running the whole length. They have on each side spacious revivifying-sheds, 221 feet long by 39 ft. 8 in. broad. The houses themselves are 221 feet long by 50 ft. 6 in. broad; and the height from the floor of the upper stories to the crown of the roof is 45 ft. 10 in. The covers of the purifiers are raised and traversed by means of overhead travelling-cranes, running on iron joists fixed along the side walls on brackets. At the end of each of the houses are stores, with iron roofs for storing and slaking lime, 77 feet by 65 ft. 8 in. Between the purifiers is an oxide-store, 78 ft. 10 in. by 65 ft. 8 in.

On each side of the building containing the exhausters, boilers, pumps, and tar-extractors, are placed the meter-houses, in each of which are cylindrical meters from the Association's manufactory at Berlin, having a capacity of 85,000 cubic feet per hour.

There are three double-lift gasholders of 165 feet diameter, and each lift 20 feet deep, with 24 cast-iron columns and one row of wrought-iron girders. The tanks are of brick, and are 167 feet in diameter and 21 feet deep. Opposite the middle gasholder is a boiler-house, containing two boilers, each with a heating surface of 215 square feet, fitted with a special arrangement for burning breeze, and used for keeping the tanks and cups of the gasholders free from ice. On the way to the gasholders are situated the two cottages, with gardens, of the foremen.

In the governor-house, 29 ft. 7 in. by 46 feet, are placed six Giroud governors—three upon each of the two 30-inch outlet-mains. In this building there is also a small telephone exchange connected with all the different buildings on the works, and with the private line to the other works, as well as a telegraphic communicator with the head fire-station in the town.

At the further extremity of the works is situated the ammonia plant, fitted with three sets of continuous apparatus for making sulphate on the system of Vorster and Grüneberg, with stores for sulphate and tanks for sulphuric acid. The stills are heated by direct firing by means of breeze, with a forced draught obtained from a fan worked by a 1-horse power gas-engine. In the centre of the works, and forming a prominent and picturesque feature thereof, is the water-tower, in which are placed two iron reservoirs; one for water out of the canal for distribution throughout the works, and for the supply to 30 fire hydrants, and the other for ammoniacal liquor for supplying the ammonia works and scrubbers. The water-tank is placed at a height of 70 feet. In the basement of the tower are stored two fire-engines; and above is a room for the firemen.

Adjoining and above the offices are extensive workshops for smiths, carpenters, painters, &c., and for the repair and testing of meters. In the same building are also a photometer and testing-rooms and a chemical laboratory; and at one end is the dwelling-house of the assistant engineer. Near the entrance to the works is the dwelling-house of the Chief Engineer. The works are approached by means of a double ascent on the opposite side of the canal, fronting

the works, and leading to an iron bascule bridge crossing the water. This work had also to be carried out by the Association.

The Linneausstraat works are situated upon a considerably smaller piece of land than the Haarlemmerweg ones; the area being 8·5 hectares, or 21 acres. But nevertheless their productive powers can be brought up to the same figure. These works were commenced at the end of 1884, and put to work on July 1, 1887. They are connected with two lines of railway—the Dutch and the State; and one side of the site is bounded, as at the Haarlemmerweg, by a canal. The two railways enter the works at opposite ends, run along both sides of the works at low levels; and are connected behind the retort-house by a traverser worked by hydraulic power. By means of three hydraulic lifts, the coal-trucks are raised to the level of the three lines running on iron viaducts through the retort-house; and, as at the Haarlemmerweg works, tram-lines run from the coke-floor to the canal to load barges, and throughout the whole of the works, for the conveyance of coke and breeze to the boilers, coke-breakers, &c., and for the carriage of other material.

The site here also being at the "polder" level, had to be filled up with sand to a height of nearly 10 feet; and some 195,000 cubic metres of sand were employed for this purpose. Altogether 19,000 piles of from 10 to 13 metres in length were employed for the foundations of the different buildings, gasholder tanks, &c.; 2600 being employed under the latter. On these works, in order to avoid having to go down with the foundations to the level of the polder water, and at the same time to keep the wooden floors always under water, the level of the latter was artificially raised by making openings in the banks of the canal running along one side of the works; the water being kept in on the other sides by means of wooden and clay dams.

Along the side of the retort-house are placed the underground tar and ammoniacal liquor tanks, which, like those of the Haarlemmerweg works, are made of wood and caulked. Up to the present, they have remained tight and in good condition. Tar is also stored in wrought-iron reservoirs above ground on the banks of the canal. From these (after being freed as much as possible from water), it is loaded into barges by steam-pumps placed in the basement of the retort-house, and which also pump the liquor from the wooden tanks into the reservoirs in the water-tower.

The retort-house is a stage one; and through it, as already mentioned, run three lines of rails on iron viaducts—the space underneath and in front forming the coal-stores. Coal is also stored in the yard between the retort and purifying houses; trucks being run on lines leading from the traverser to between the heaps. This house is 304 feet long by 221 feet broad, and affords room for 80 benches in two lines back to back, and of which 56 are built; 26 being regenerator benches with nine retorts, 16 on the system of Munich, and 12 on that of Hasse-Didier. The remainder are fire-bar benches with seven retorts, but built upon arches in a similar manner to those previously described.

The hydraulic mains are of wrought iron of the ⊃ form, 2 feet broad by 2 feet deep, placed at the top of the benches, and supplied with Drory tar "take-offs," by means of which advantage is taken of the difference in the specific gravity between the tar and the ammoniacal liquor so that the former flows off continually, and only the liquor stays in the mains. On leaving the hydraulic mains, the gas passes into wrought-iron cooling-mains, placed on the top of the benches, and against the end outside walls of the retort-house; and from thence to the condensers. These consist of two batteries of annular condensers, supplied by Messrs. C. & W. Walker, composed each of six upright columns, 50 feet high, of 4 feet outside diameter, and 3 ft. 6 in. inside.

Since 1892, the hydraulic stoking machinery of Messrs. Foulis and Arrol has been successfully and successively introduced; and there are now in winter four drawing and four charging machines in use. Since September, 1894, no manual labour has been employed. The hoppers of the charging-machines are filled by means of light hydraulic cranes attached to the machines; and the coal is broken so far as necessary by hand—circumstances not allowing of the erection of overhead hoppers, breakers, elevators, &c. Connected by a covered passage with the retort-house on the ground level, is a building for the use of the stokers, containing a mess and reading room, and shower-baths supplied with hot and cold water.

Parallel to one side of the retort-house, and separated therefrom by a road, is placed a long series of contiguous buildings, containing the smithy (laboratory and photometer room above), carpenters' and other shops, stores, pump-room, hydraulic accumulators and pumps, exhausters, and boilers. The three exhausters, supplied by Messrs. B. Donkin and Co., are placed in a spacious room, 42 ft. 9 in. by 40 ft. 4 in. They are coupled direct to 14-horse power horizontal steam-engines, and are made to pass 125,000 cubic feet per hour. Foundations are built for a fourth exhauster and engine.

The two pumping-engines of 36-horse power for the hydraulic machinery, and the two high-pressure accumulators for the railway lifts and the low-pressure one for the stoking machinery, are placed in a building 42 ft. 9 in. by 27 ft. 9 in; the accumulators being in a separate compartment. The pump-room is 42 feet by 13 ft. 7 in., and contains six direct-acting steam-pumps in duplicate, for pumping water, ammoniacal liquor, and tar, with foundations for the erection of two additional pumps. The boiler-house—49 feet by 48 ft. 9 in.—contains five Cornish boilers, fitted with Perret's grates, for burning breeze, and have each a heating surface of 490 square feet. From the exhausters, the gas passes to the three tower scrubbers (foundations prepared for a fourth) erected by Messrs. C. & W. Walker. They are 12 feet diameter, and 65 feet high. Two are filled with coke, and one with boards; and at the bottom of each is fitted Walker's patent washer.

The purifying-house is a spacious building, 301 feet by 180 feet, including the side wings, for storing slaked lime and oxide of iron, and for revivifying the latter. The purifiers, erected by Messrs. C. & W. Walker, consist of two sets placed in two lines, each composed of eight boxes, 30 feet square and 6 feet deep; and they are placed on the ground level, with a basement underneath, by which the centre-valves, mains, and connections are easily accessible. The covers of the purifiers are raised and moved by means of two "Goliath" travelling cranes, running on rails placed on the floor.

The meter-house is 72 ft. 8 in. by 36 ft. 8 in., and contains two square meters, erected by the Gas-Meter Company, Limited, made to pass 120,000 cubic feet per hour. Space is left between the two existing meters for the erection of a third of the same size.

The two triple-lift gasholders were erected by Messrs. S. Cutler and Sons, and are 150 feet in diameter. The inner lifts are 25 ft. 6 in. deep; and the other two, 25 feet. Each gasholder has sixteen cast-iron columns, with two rows of wrought-iron lattice girders. The tanks are of brick, encircled with six iron rings, 7 inches by 1¼ inches, and are 152 feet in diameter and 26 feet deep.

On the street side of the works is situated the governor-house, 40 ft. 7 in. by 29 ft. 2 in., and containing two of Parkinson's double-cone governors, connected with the two 30-inch outlet-mains from the works. In this building is also the telephone exchange, connected with all the buildings on the works, offices, engineer's dwelling-house, &c., and the private line between the two works. In this building is also telegraphic communication with the head town fire station. At one corner of the works, fronting the street, is situated the dwelling-house of the Engineer; and at the opposite corner, the offices, with dwelling above for the Assistant Engineer. Between this latter building and the workshops is the foreman's house. Behind the scrubbers is placed the water-tower, 82 feet high, and containing tanks for ammoniacal liquor and water from the canal and from the town supply.

At the extremity of the works, beyond the gasholders, are the sulphate of ammonia works, fitted with two sets of apparatus on the continuous system of Dr. Feldmann; space being provided for the erection of a third. The apparatus of Dr. Feldmann has given great satisfaction; and although much more compact and taking up less room than the three sets of Vorster and Grüneberg at the Haarlemmerweg works, they have the same capacity, and produce if anything salt of a better colour.

Adjoining the sulphate-works is a boiler-house containing two Cornish boilers, fitted with Perret grates for firing by means of breeze. These boilers (each with a heating surface of 377 square feet) are employed for the distillation of the ammoniacal liquor, and for keeping the gasholders

and tanks free from ice in winter. In the neighbourhood of the sulphate-works, are sulphate stores and tanks for storing sulphuric acid, which is delivered direct from the tank-trucks.

For some time, at both works, the use of cannel for enrichment has been almost entirely discontinued, and replaced by carburine and benzol. In spite of the exceptionally bad soil and the number of water-mains and bridges to be crossed, the leakage at Amsterdam is very small—thanks to the great care taken in laying the whole system of mains. Very full lead joints were made; and the principle was adopted of making use of no mains of less than 4 inches diameter, of laying in every street mains on both sides, and of laying all services in wooden troughs in pitch. All mains, before being covered in, were tested under a pressure of 20 inches. Constant attention is also paid to detect leaks; all mains crossing bridges and leading to water-mains being systematically inspected annually.

It is also a rule that no work for drainage or other purposes shall be carried on in the streets without someone from the works being in attendance; while tests also are constantly made with chloride of paladium. From all mains laid in streets with asphalt covering, iron ventilating-pipes run to the edge of the foot pavements; and these pipes are also tested from time to time for leaks. Two 30-inch mains, uniting the two works, traverse the town on both sides, and are connected by mains of from 9 inches to 16 inches diameter. The capacity of the system is so ample that the highest pressure required to be given at the works is some 16-10ths; and all over the town the pressure is then about 13-10ths.

The total length of mains at present is nearly 187 miles; and the number of public lights is some 6700. The architect of both works was Mr. J. Gosschalk, of Amsterdam. The Haarlemmerweg works were commenced under the engineership of the late Mr. Miltner, and were completed by the late Mr. J. Pazzani, C.E., who was also Engineer for the Linneausstraat works.

On the Keizersgracht and Prinsengracht, covering nearly a quarter of an acre, are situated the central offices and the workshops, fittings, stores, &c., for the carrying out of work in the town; a considerable fittings business being done by the Association. In the same building as the offices, are photometer and testing rooms, a laboratory, and a show-room.

Discussion.

Mr. HOLGATE said the works appeared to be admirably conceived; but he did not understand why there should be such a large number of purifiers erected, each of so comparatively small an area. He would like to ask if any arrangement were made for removing the sulphur compounds. The construction of the tanks would be probably somewhat different to those in England, having regard to the water-logged nature of the strata; and he should like to know what means were adopted to make them water-tight. He also noted that the depth of each lift, in comparison to the diameter, seemed rather small.

Mr. MARSHALL said he had inspected the works; and they were certainly very beautiful. He should like to know the cost per ton of building them, because the expenditure seemed to him very lavish. He congratulated the Engineer and Architect on being so liberally supplied with funds.

Mr. C. C. CARPENTER said he was pleased to see such admirable arrangements made for bringing in the coal, dealing with it in the retort-house, and getting the resultant coke direct to the canal. There were very few plans of works in which he had seen such foresight shown in the matter of the economical handling of the raw and residual material as in this case. Putting down lines of rails of a small gauge all over the works, was not a costly undertaking; and it would effect an enormous saving in the transport of material. No doubt this important matter had full consideration when the works were laid out; and it must conduce to their economical working.

The PRESIDENT said he should deprecate any attempt to discuss the construction of the works that day, because it would be more profitably done on the works themselves, where he hoped to meet most of the members of the Institution in September next.

Mr. SALOMONS said he would take the President's hint, and not go into many details in reply. He presumed Mr. Holgate's inquiry referred to the Haarlemmerweg works, because the number of purifiers on the other works was less; and they were of larger size. In the first works, they were made 20 feet square; but he really could not give the reason. He had nothing to do with designing or building them, and could not himself imagine why the system was adopted of putting up a large number of small purifiers. There did not seem to be any special reason for it; and, at any rate, in the building of the second works, a different method was adopted. The mode of purification was the London system. In each set there were eight boxes—the two first, carbonate boxes filled with lime and oxide; then four sulphate boxes; and then two catch-boxes. The catch-boxes were used to a great extent to take up the last trace of ammonia, because there was a very stringent stipulation with regard to that—only about a quarter the quantity being permitted which was allowed in London. There was nothing particular in the construction of the tanks. They were puddled, and rendered with cement inside. The depth at the Haarlemmerweg works was 20 feet; and at the other works, it was 25 feet. The ground was bad, and of a treacherous quality at the Haarlemmerweg works; and so much water was met with, that it was not thought safe to go to a greater depth than 20 feet. The cost per ton was rather an indefinite question. Did it refer to the cost per ton on the present consumption of coal, or to the consumption with which the works were capable of dealing? He might say that the total amount expended at Amsterdam, including the works and the very extensive and effective system of mains, the placing of meters and services, and the very elaborate lamp-posts, was something like a quarter of a million sterling. At present, the works were carbonizing 108,000 tons of coal; but they were capable of doing considerably more than was now demanded of them.

Institution of Heating and Ventilating Engineers.—An association has been registered under this title, with 100 members, to promote the interests of the profession of heating and ventilating engineers.

The Liverpool City Council and Street and Electric Lighting on the Continent.—The Liverpool City Council have deputed Mr. C. Petrie, the Chairman of the Lighting Committee, Mr. W. Oulton, the Deputy-Chairman, and Mr. Alderman F. Smith, Mr. A. B. Holmes, the City Electrical Engineer, and Mr. C. R. Bellamy, the Superintendent of Street Lighting, to visit the principal cities on the Continent, to inspect the various methods of street lighting and electrical supply in use there.

Southern District Association of Gas Engineers and Managers.—We are asked by the Honorary Secretary of the Association (Mr. D. H. Helps) to notify that the spring meeting will take place on Thursday, the 27th inst., when a visit will be paid to the Croydon Gas-Works, and also an inspection made of the electric light works in the town. After luncheon, kindly provided by the Directors of the Gas Company, the members will be driven through Addington district to the Crystal Palace, where an opportunity will be afforded of viewing the Victorian Exhibition, after which tea will be served in the Palace.

Localizing Faults in Electric Light Mains.—This subject has been dealt with by Mr. F. C. Raphael, in a volume which has lately been issued by "The Electrician," Printing and Publishing Company, Limited, and a copy of which has been forwarded to us. Beyond a few short articles that have appeared in the technical journals from time to time, the subject taken up by the author has not been treated; and therefore he has endeavoured to fill a gap which has hitherto existed in technical literature. The work is intended to be a handbook for central station engineers; and it will be found useful by gas engineers whose duties include the supervision of electric lighting plant. The text is very fully illustrated.

Manchester District Institution of Gas Engineers.—The spring meeting of the Institution is to be held at Preston next Saturday. According to the programme issued by the Honorary Secretary (Mr. S. S. Mellor, of Northwich), the members will reach Preston in time for a visit to the Harris Free Library and Museum—in company with Mr. Henry Green, Engineer and Manager of the Preston Gas Company—before luncheon, which will be served in the Company's offices, at the invitation of the Chairman and Directors. After this the business will be transacted under the presidency of Mr. R. Porter, of Elland. It will be of the briefest character; consisting only of the confirmation of the minutes of the previous meeting and the election of seven new members. The party will then proceed, in conveyances provided by the Directors, to the Moor Lane Gas-Works, where Mr. Green's large purifiers, as described and illustrated in the "JOURNAL" about eighteen months ago, are in use. A move will next be made to the Preston Docks, where, by arrangement with the Corporation, a steamer will convey the party down the Ribble to Lytham, where tea will be served at the Clifton Arms Hotel.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1153.)

THE general tendency was better all round in the Stock Markets last week; and prices of almost every description show an appreciable advance. This was largely due to the improved position of things in South Africa, which have recently been the most disturbing element; and this, coupled with the apparent certainty that the war in Eastern Europe cannot be long protracted, had a cheering effect. It cannot be said that business was very brisk—the revival of activity not yet being quite in full bloom; but still it is getting well on the way to that desired condition. The Bank rate, after standing for a month at 2½ per cent., was reduced on Thursday to 2 per cent. It is just eight months since last it stood at 2 per cent. The market is extremely easy, and seems likely to continue so. The Gas Market has had another very good week. Not that transactions have been very extensive, for they were below the level of the preceding week, but that issues pretty well all round were strong and buoyant. In Gaslights, the "A" opened with a little hesitation, but quickly went to the front, and marked 315. Then it relapsed into a rather quiet state; but the quotation at the close showed an advance of a couple of points. Dealings in the secured issues showed their strength; and the "B" 4 per cent. limited had a smart rise. South Metropolitans showed no disposition to move; and only a few transactions took place at unchanged prices. But the debenture stock advanced; and it is now at a choice figure. Commercials also showed a moderate advance; but there was very little business done in them. Two or three deals were all that the Suburban and Provincial division could contribute; and prices remained unchanged. A moderate amount was done in the Continental Companies at steady figures. Imperial did not move; the *ex div.* prices being the equivalent of those *cum div.* in the earlier part of the week. Cagliari rose one. Several of the remote undertakings showed improvement; and the only relapse was in Monte Video, which is undergoing a little "electric disturbance." Water was decidedly better, though very inactive. Several issues moved upwards, including those which lately were adversely affected.

The daily operations were: The Gas Market opened fairly brisk; and prices were good on Monday. Commercial old rose 2; and Gaslight "A," 1; but Monte Video fell ½. Chelsea Water advanced 1. Business was much quieter on Tuesday; but Commercial old gained 1, and ditto new 2. Gas business was perhaps a shade better on Wednesday, but not much; and quotations stood still. In Water, East London moved up 1½; and Lambeth tens, 1. Quiet prevailed in Gas on Thursday; but the advance continued. Gaslight "B" rose 2½; Cagliari, 1; and Cape Town, ½. In Water, Lambeth went up 2 more; and East London, 1. Transactions in Gas continued about the same on Friday, coupled with further rises. Gaslight "A" improved 1; South Metropolitan debenture, 2; Hong Kong, ½; and Belgrano, ¼. In Water, Chelsea rose 2; Grand Junction, 3; and East London 3 per cent. debenture, 1. Saturday was much as usual. The only move was a rise of ½ in Cape Town.

ELECTRIC LIGHTING MEMORANDA.

Concerning the Transfer of Electric Light Undertakings—The Case for the Opposition—Let the Orders Alone—Conclusion.

THERE is at the present time, in towns where electric lighting is undertaken by companies, a strong movement favouring the transfer of the business to the local authorities. This impulse is found manifesting itself under widely different conditions. In cities like Birmingham, where the supply of electricity by private enterprise is a commercial success, there is an intelligible desire on the part of a section of the public to see the work included among the duties of the Municipality. There are other places, which need not be named, where those who are interested in struggling electric lighting companies would be unaffectedly glad to see the local authority step in and relieve the undertakers of their responsibilities in this regard. It seems appropriate to discuss this subject now, inasmuch as at the last quarterly meeting of the Birmingham City Council, Mr. T. Fletcher moved, and succeeded in carrying *nem. con.*, a resolution instructing the General Purposes Committee "to consider and report as to the desirability, or otherwise, of the Council purchasing the undertaking of the Birmingham Electric Supply Company, Limited; also to ascertain and report whether, and upon what terms, the Company are willing to transfer their undertaking to the Council." Mr. Fletcher supported his proposal in a speech of great ability, based upon the expression of the speaker's opinion that there is among the citizens a growing opinion that some day or other it will be desirable, in the public interest, for the Council to acquire the electric lighting rights, and that the present is an opportune time to consider the question, because the longer it was delayed the more difficult and expensive it might become." Mr. Fletcher's justification for holding this opinion was completed by the unanimous vote he afterwards secured.

It is expedient to traverse these declarations; and we desire to do so with all respect for Mr. Fletcher and those who think with him (whether in Birmingham or elsewhere) that the present is an opportune time for raising the question of the municipalizing of those electric lighting undertakings which are not public property. In order to do this, it is not necessary to begin by appraising the value of every undertaking of the kind that might be regarded as a case in point. On general principles, we are ready to maintain that where an electric lighting company is carrying on business under a Provisional Order, the strong presumption is against interfering with it until it has run its appointed course. The legislature has set bounds to the duration of all Electric Lighting Orders; and the arguments for allowing them to run out are far weightier than any that can be marshalled on the other side. This consideration of the essentially transient nature of Electric Lighting Orders, would seem to negative Mr. Fletcher's contention that the longer the purchase is delayed the more difficult and expensive it will prove. Had he taken the Town Clerk's opinion on the point before making this declaration? It can hardly be that, if this experienced officer's views had been ascertained, Mr. Fletcher would not have been informed that the best and easiest time to deal with an Electric Lighting Order is that appointed by Parliament for the purpose. Mr. Fletcher was thinking, of course, of the apparent analogy of the acquisition by the Corporation of the local gas undertakings. But this analogy is truly more apparent than real. To put it shortly, statutory gas supply has no appointed duration. It is an absolute freehold, from the legal point of view; while from the industrial standpoint, it is a business with a past that has no secrets, and a future not likely to bring many or great surprises. Neither of these observations can be made with reference to electric lighting, which has hardly any past and a problematical future.

To say as little as possible on the latter score, why this hurry to anticipate the appointed course of events? Where there is an electric lighting company with an Order, the local authority cannot take possession of their property, with or without the owners' consent, and carry on the business without obtaining an Act of Parliament for the purpose. If the local authority wish to expropriate an electric lighting company, this can only be done by buying them out at an altogether fancy price, in fixing which the public body are not likely to get the best of the bargain. Liverpool is a prominent case in point. People are fond of talking about the exorbitant prices asked by gas companies for their property. But it is often overlooked that gas companies and their advisers are not exceptional in desiring to obtain the best possible terms for what they have to sell. Moreover, in buying a gas undertaking, it is easy to show precisely for what the consideration is to be paid, which is not the case with an electric lighting concern. The latter is strictly limited in time; and there is no guarantee against competition even for the limited period reserved by the Order. Moreover, electric lighting plant is almost all of a perishable character, in a degree to which gas apparatus supplies are parallel. When a local authority acquires a gas-works, there is at least a reasonable expectation that the plant will continue able to produce gas. With electric lighting plant, boilers, engines, and dynamos may all be old-fashioned and need renewal; and an eager purchaser would not necessarily be aware of the truth until it was too late The clause as to purchase in the Electric Lighting Act effectually deals with this possibility; but the moment that the protection of the Act is put on one side, there is no knowing what may happen.

Wherefore we say, with what cogency our readers must decide for themselves, that there is no general justification for interfering with an Electric Lighting Order carried out by a private company until the appointed time. If the company should be prosperous, let them enjoy their prosperity for the short time that is allotted to them by law. The consumers cannot suffer, for they are sufficiently protected by the terms of the Act. No additional price or difficulty in the way of acquisition by the local authority can accrue from following this course, because the Act has provided against both eventualities. If an electric lighting company should be in difficulties, there is still less reason for the intervention of a local authority before the appointed time. Even where local authorities have been tempted to take this course by the offer of the electric lighting plant at a heavy reduction upon cost, they have seen reason to be sorry for their precipitancy. Commercial men are made acquainted, too often for their comfort, with the wisdom of cutting off a loss at 50 per cent. discount; but there is no reason why public money should be employed in any such desperate enterprise. The late Earl of Malmesbury was accustomed to ask: "Why can't you let it alone?" when enthusiastic reformers pestered him with suggestions for embarking the national interest in this or that new departure. The counsel seems peculiarly appropriate with regard to these proposed interferences with the beneficent working of the Electric Lighting Act. Forty-two years is, after all, a short time in the history of an industry and of a municipality. It is sometimes made a reproach to the present generation, that they are too prone to mortgage their corporate estates for the sake of causes which their successors may prefer to work out in ways we wot not of. In electric lighting especially, it appears to us that municipalities ought to walk warily, and particularly to avoid purchasing with the public funds intangible assets which the wisdom of Parliament has already as far as possible rendered unmarketable.

OBITUARY.

By the death, on Friday, the 7th inst., in his 86th year, of Mr. W. PEEK, of Devonport, a vacancy has occurred on the Board of the Devonport Gas Company. Deceased was one of the oldest and most respected of the public men in the borough. He was elected a member of the Town Council in 1851; and retained his seat till his death. He was made an Alderman in 1859, and was Mayor in 1886-7 and the following year. Though so advanced in life, he attended a meeting of the Board of the Gas Company on the 4th inst. On the following day, he was found suffering from bronchitis; and the illness proved fatal. At the funeral on Thursday, the Gas Company were represented.

PERSONAL.

At the last meeting of the Liverpool City Council, Mr. C. R. BELLAMY was appointed Inspector of Electricity Meters, in addition to his present duties of Superintendent of Street Lighting, Gas Examiner, and Official Inspector of Gas-Meters, with an increase of £50 per annum in his salary.

Owing to advancing years, Mr. R. W. FORD has found it necessary to tender his resignation of the position of Secretary to the Portsmouth Water-Works Company, which he has held since the Company started. He will be succeeded by Mr. J. L. WILKINSON, who has occupied the post of Chief Clerk for the last twenty years.

Mr. C. B. NEWTON, of Carlisle, has not long held the position of Consulting Engineer to the Rotherham Corporation, in connection with the proposed extension of the gas-works. The appointment was only made on the 7th ult.; and, in consequence of circumstances which have since arisen, he has tendered his resignation, and it has been accepted.

Mr. J. SMITH, the Chairman of the Matlock District Council, is also Chairman of the Water Company. The Council have approached the Company asking the price they are prepared to accept for their works; and Mr. Smith has come to the conclusion that the two offices are now incompatible. He has consequently resigned the chairmanship of the Council.

The salary of Mr. H. ROBERTS, Engineer and Manager of the Ipswich Corporation Water-Works, has been raised by £75 per annum, as from March 25. In making the recommendation to the Council, the Water Committee stated that they were unanimously of opinion that the great success attending the working of the undertaking was almost entirely due to the ability and untiring energy of Mr. Roberts.

Mr. F. TORPEY, who during his occupancy of the position of Manager of the Uckfield Gas Company, Limited, has brought the undertaking into a very prosperous condition, is now leaving to enter upon his duties as Manager of the Whitwick and Coalville Gas Company—an appointment he received about two months ago. Mr. Torpey was an active member of the Uckfield Total Abstinence Society; and he has been presented by his fellow-members, and those of the local Band of Hope, with an illuminated address and a silver inkstand, in recognition of many years of faithful and earnest work, and as a small token of their esteem. Mr. Torpey will be succeeded at Uckfield by Mr. F. CHALMERS, of Stevenston.

Dr. Percy Frankland on London Water.—At the weekly meeting of the Society of Arts to-morrow evening, Dr. Percy Frankland will read a paper on "London Water Supply."

The Gases Occluded in Coal Dust.—The results of researches which have been carried out by P. Bedson form the subject of a communication by A. Halleux to a recent number of "Glückauf." Bedson examined the sifted dust from samples of coal from the Hutton seam of the Ryhope pit—a coal well known as being of a peculiarly dangerous character. The dust was first kept in a vacuous flask for twenty days at 86° Fahr.; and the flask was then exhausted, and the temperature raised to 122° Fahr. for ten days. It was again exhausted, and kept at 176° Fahr., and finally at 212° Fahr. The gases withdrawn from the flask amounted in all to 112·4 c.c. per 100 grammes of coal dust. The samples withdrawn at the higher temperature contained a strikingly greater proportion of carbonic acid. The combustible gases were methane and heavier hydrocarbons; the proportion of olefines being greatest in the last samples. The bulk of the methane must have already escaped while the dust was exposed to the air. A research was then made with freshly won coal, of which 100 grammes yielded 818·1 c.c. of gas. The combustible constituents of the first portion were hydrogen and methane; those of the next two portions were wholly methane; and those of the last were methane and ethane. The same coal was then finely powdered, and yielded similar gas to that yielded by the old dust. The gases given off at higher temperatures were then examined. At 273° Fahr. they consisted chiefly of ethane; at 363° Fahr., of butane; and at higher temperatures, of hydrocarbons still richer in carbon. These heavier hydrocarbons ignite at a lower temperature than methane; and a smaller proportion of them forms an explosive mixture with air. The danger of explosion or ignition of coal dust appears to be largely due to their presence.

TECHNICAL RECORD.

INSTITUTION OF CIVIL ENGINEERS.

The Engineering Conference.

We have received the programme of the forthcoming conference on engineering questions which, as mentioned in the "JOURNAL" last week, is to take place in London, under the auspices of the Institution of Civil Engineers, from the 25th to the 27th inst. On the first-named day, all the sections will meet in the large hall of the Westminster Town Hall, to hear an address by the President, Dr. J. Wolfe Barry, C.B., F.R.S. At the close of this, the sections devoted to machinery and the applications of electricity will enter upon their labours. Mr. W. H. Preece, C.B., F.R.S., will introduce the subject of the transmission of power by electricity; Mr. E. B. Ellington, who is Joint Engineer with Mr. Corbet Woodall of the Hydraulic Power Supply Company, will call attention to the value of water for a similar purpose; and Dr. Hopkinson, F.R.S., will deal with the various other agents available for the work. The Water-Works, Sewerage, and Gas-Works Section will subsequently meet in the Council Chamber of the Guildhall, Westminster, when Mr. J. Mansergh, the President of the section, will invite discussion on the law and allocation of underground water. On the following day, this section will deal with several matters of interest to our readers. Mr. Corbet Woodall will introduce the subject of water gas; Mr. J. Emerson Dowson will set forth the advantages of gas for power purposes; Dr. E. Frankland will say something as to the value of bacteriology in connection with water supply; and Mr. W. Fox will deal with the relation between rainfall, the flow of water off the ground, and the actual yield of reservoirs. Arrangements have been made for visits on the first day to the Hydraulic Power Supply Company's works, the Deptford station of the South Metropolitan Gas Company, and the New River Company's works at Finsbury Park; and on the 27th to the London Water Companies' river-side works from Hammersmith to Sunbury.

THE AGRICULTURAL VALUE OF SULPHATE OF AMMONIA FROM BLAST-FURNACES.

At the Meeting of the Iron and Steel Institute in London last week, a paper on the above subject was presented by Mr. F. J. R. CARULLA, F.C.S., Chairman of the Nottingham Section of the Society of Chemical Industry; but, owing to want of time, it had to be taken as read. In view of the interest shown by the author in this question, as testified by communications which have appeared in our columns, and of the recent action of the Association of Sulphate of Ammonia Manufacturers, we give the principal portions of the paper.

The hazy ideas that prevail on the subject of nitrogenous manures among farmers seems to call for more accurate knowledge on the part of those who produce these commodities, in order that they may be able to educate their customers. It is therefore especially necessary for ironmasters, who have now become such large makers of sulphate of ammonia, that they should not harbour any doubts as to the true value of this product as a fertilizer for agricultural purposes. The nitrate of soda producers have, by their most praiseworthy efforts, succeeded in creating quite a literature on their special subject; and sulphate of ammonia is being left behind, more because nitrate of soda is so persistently pushed to the front than because of any inherent deficiency in its intrinsic value. Meanwhile, many sulphate of ammonia makers quietly accept the situation without protest—some, indeed, almost appearing to be converted to the new theories.

Until very recently, it was always acknowledged that ¾ cwt. of sulphate of ammonia was equal in fertilizing power to 1 cwt. of nitrate of soda; or, to be perfectly safe, say that 4 cwt. of sulphate equalled 5 cwt. of nitrate. However, since iron blast-furnaces have begun to send their make into the market in increasing quantities, the intrinsic value of sulphate of ammonia as a fertilizer appears to have so diminished as to have become equal to that of nitrate of soda, weight for weight. Surely no one will say that this can be due to any inferiority in the product from blast-furnaces. Yet the increased make and the apparently diminished intrinsic value are contemporaneous events that would lead a superficial observer to that supposition. It is easy to say that over-production is at the bottom of the mischief; but that is not all. Our friends the nitrate of soda producers have gradually won for themselves a position of pre-eminence that they now stoutly try to maintain, and do so successfully at the present moment. No less an authority than the Secretary of the Permanent Nitrate Committee, replying to certain correspondence on the subject of sulphate of ammonia as a fertilizer, said in the "Birmingham Daily Post" of Feb. 20, 1897: "For the majority of purposes, nitrate of soda, weight for weight, is practically of greater value to the farmer than sulphate of ammonia." You will thus see that the point has not been overstated; for sulphate of ammonia has not fallen from its former position to be the equal of nitrate of soda, but has even come to be regarded as its inferior. The public seem to share in this belief, for they gladly pay more for nitrate of

soda than for sulphate of ammonia, so great is the power of advertisement.

It will occur to anyone who gives the matter careful thought, that no better proof could be adduced of the equal intrinsic worth of the unit of nitrogen in the two manures than the fact that no difference is made between them in the Fertilizers and Feeding Stuffs Act passed in a recent session. If there really be any material difference between them,and the unit of nitrogen in nitrate of soda is really worth more than is the same unit in sulphate of ammonia, what can the Nitrate Committee have been doing to allow the Bill to pass through Parliament without protest? It was not a Bill of which they could have been ignorant. This view was promulgated during a discussion before the Nottingham Section of the Society of Chemical Industry at Burton-on-Trent in January last.* Expression has been given to it, besides, in the newspapers since that date whenever opportunity has offered. No reply has, to the author's knowledge, been vouchsafed to the argument; and he therefore ventures to advance it as an important proof of the equal value of the unit of nitrogen in the two fertilizers.

It may here be mentioned that Mr. James O'Sullivan, during the discussion referred to above, expressed the opinion that the great obstacle to the spread of the use of sulphate of ammonia in this country was its name, and that if it could be re-christened, so as to convey the idea of nitrogen in the same way that the word "nitrate" does, it would be a good thing. Accepting this view as in some measure explaining the anomalous position of the two fertilizers towards each other, the author suggested that sulphate of ammonia should be called "Nitrogenous Sulphate" for the purpose of its sale among home farmers. No one would be able to say that he is in any way misled; for a substance which contains upwards of 25 per cent. more nitrogen than nitrate of soda, and which is besides the richest nitrogenous manure available, is surely entitled to be so called. When one considers how successful the application of suggestive names has been in other departments of industry and of commerce, it must be admitted that the neglect of sulphate of ammonia, with its nearly 21¼ per cent. of nitrogen, for nitrate of soda, which barely contains 16½ per cent., may in part be due to prejudice created by the persistent drumming of the nitrogen idea on behalf of nitrate of soda, which a change of name, making it also prominent for sulphate of ammonia, might remove.

It will naturally be asked: What is the result of comparative experiments made with the two fertilizers? A search has been made with the object of answering this very pertinent question. But as sulphate of ammonia made its way more by its own intrinsic worth than by the praises of its friends, there is very little specially written on the subject. Perhaps this is not altogether a disadvantage, as one is thrown on the nitrate of soda literature, which has been largely added to by the award of considerable money prizes for essays showing its value as a fertilizer. Such works must necessarily be looked upon as biassed in all that relates to nitrate of soda; but nothing can impair the worth of statements made in them that tell in favour of sulphate of ammonia.

Professor Paul Wagner, Director of the Agricultural Research Station at Darmstadt, in his work on "The Increase of the Produce of the Soil through the Rational Use of Nitrogenous Manures," though showing a decided bias for nitrate of soda, gives, in the true scientific spirit, results that must cause astonishment to those lukewarm friends of sulphate of ammonia who, little by little, are being converted to the belief that nitric nitrogen, as it appears in nitrate of soda, is more effective than ammoniacal nitrogen. Professor Wagner carried out or initiated during two years tolerably comprehensive experiments on the effect of manuring with ammonia as compared with manuring with nitrate of soda; and he gives the result of his researches in a table which shows in the most convincing manner the practically absolute identity of value for the unit in the two forms of nitrogen. He says: In my researches, which were carried out with grass, oats, rye, buckwheat, and rape, usually no considerable difference between the effect of ammonia and that of nitrate showed itself, if the manure was applied in spring, and immediately before the sowing, to a clayey soil which contained a small percentage of carbonate of lime. In several series of experiments, the effect of ammoniacal nitrogen (*b*) was fully equal to that of nitric nitrogen (*a*), as the following examples will show:—

Manure, Nitrogen, per Acre.	Yields of Rye.		Yields of Grass.		Yields of Buckwheat.	
Lbs.	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)
18	43·1	47·4	..	..	35·9	37·2
27	50·0	51·7	..	..	41·8	39·7
36	56·4	55·6	15·0	15·7	45·7	45·6
45	58·1	58·2	17·0	16·9	46·1	48·4
54	62·8	61·6	17·5	18·4	51·8	53·3
63	..	..	18·7	19·3	..	..
72	..	..	20·6	20·8	..	..
0	38·0		7·6		31·5	
Average	54·1	54·9	17·8	18·2	42·3	42·8

* See *ante*, p. 350.

It may be advisable, in order to prevent any possible misconception, to repeat that ¾ cwt. of sulphate of ammonia is practically equal in nitrogen contents, and consequently in fertilizing power, to 1 cwt. of nitrate of soda. It would be in this proportion that the two manures were applied in the various experiments of which the results are given in the table.

Can anyone after this doubt the practically equal efficacy of the same amount of nitrogen, whether present in a manure as nitric acid or as ammonia? No cases of failures can affect the value of such a series of results. All that can be said, if failure occurs, is that the proper conditions have not been present to make the nitrogen available. Cases in plenty are to be met with where nitrate of soda has not yielded the result that was properly expected from it; and this may also happen with sulphate of ammonia. It would be just as fair to infer from experiments performed under unfavourable conditions that the nitrogen in nitrate of soda is inferior to its value in normal experiments, as it is to do this in the case of sulphate of ammonia under similar conditions.

As an example of the extreme unfairness with which facts may be presented so as to injure sulphate of ammonia (possibly without any real intention to do so), the following extract from the work above quoted will show:—

Some experiments which I carried out with winter rye gave the following numbers as the averages of four closely agreeing parallel experiments. Every 10 lbs. of nitrogen as compared with no manure gave the following increase in the crop:—

	Grain. Lbs.	Straw. Lbs.	Grain and Straw. Lbs.
1.—No nitrogen in autumn, all the nitrogen given in spring in the form of nitrate of soda.	215	729	954
2.—All the nitrogen given in autumn in the form of sulphate of ammonia, no nitrogen in spring	41	169	210
3.—The smaller part of the nitrogen given in autumn in the form of ammonia salt, the larger part in spring as nitrate of soda.	145	575	720
4.—The smaller part of the nitrogen given in autumn in the form of nitrate of soda, the larger part in spring, also as nitrate of soda	156	594	750

Of course, it may be answered to the charge of unfairness in the way the above experiments are presented, that they were conducted on the assumption that the nitrogen was equally effective in whatever form given, and that they really only show that it is simply waste to give it in autumn in any form. That it makes little difference in what form it is administered, experiments 3 and 4 pretty well prove. Just consider, however, the effect produced on the ordinary reader on instituting a comparison between experiments 1 and 2. The fact that, in the first case, the nitrogen from the nitrate of soda was presented to the plants at the most favourable period, and that the opposite was the case with the sulphate of ammonia, will avail little in the long run. The majority of readers will simply remember the good effect produced by the nitrate of soda, and the failure of the other manure. Nothing better than this example could be adduced to show the crying need for books written in the interest of sulphate of ammonia to distribute among farmers. Almost everything that now reaches the gardener and agriculturist is written in the interests of nitrate of soda. So much is this the case, that articles in popular papers are to be found in which the chief chemical manures are described without even mention being made of sulphate of ammonia.

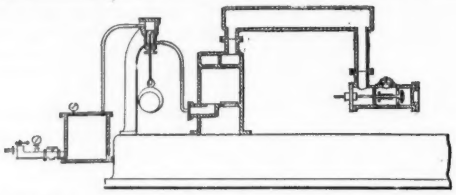
The object of this paper is to direct earnest attention to this anomalous state of affairs in regard to so valuable a bye-product; to give reasons why such an unfair condition of things should not continue; and, if possible, to initiate a discussion that may help to bring about the much-desired improvement. It may, however, be added, that so great has been the benefit rendered by two of the newest industries—viz, the manufacture of basic steel, and the recovery of bye-products from blast-furnace gases—to agriculture, the oldest of them all, that, with basic slag to be used in the autumn and sulphate of ammonia in the spring, the farmer can now provide himself wholly, from sources at his very gates, with the most necessary ingredients for the cultivation of his crops. As these sources all lie within the province of the Institute, it will be the hope of every member that the home farmer may speedily learn to appreciate benefits that can greatly improve his position, and that can help to bring about that return of prosperity to agriculture so essential to the well-being of the nation.

Heat and Heat Engines.—We have received from the Technical Publishing Company, Limited, of Manchester, a copy of Mr. W. C. Popplewell's elementary treatise on the above subject. The author is the Senior Assistant Lecturer and Demonstrator in Civil and Mechanical Engineering at the Yorkshire College, Leeds; and in the above-named work he has endeavoured to place before engineers and students of engineering a clear and concise account of the theoretical considerations governing the actions and design of the chief of those machines which come under the general designation of "heat engines," without dealing with their practical working. The chapters on gas-engines occupy 100 pages of the book; and there is also a chapter on oil-engines.

REGISTER OF PATENTS.

Controlling the Gas Supply to an Explosion Motor.—Donaldson, W., of 38, Parliament Street, S.W. No. 5277; March 9, 1896.

This invention relates to the control of the pressure of the gas as, and when, admitted to mix with atmospheric air to produce an explosion; and it consists in an arrangement whereby the inlet-orifice velocity of the gas, drawn in from the source of supply, together with the air from the atmosphere, shall always bear a constant ratio (as far as possible) to that of the air. This result is effected by minimizing the variations of pressure in the gas-main, and further by so controlling the actual orifice of gas admission to the space between the gas-valve and the orifice of admission to the mixing chamber for gas and air, that the velocity of ingress of the gas bears a constant ratio to the velocity of ingress of the air.



A receiver is employed as shown between the gas-main and the gas-admission valve, so as to maintain the pressure on the inlet side of the valve constant, even where there is irregularity in the amount of opening or in the actual closure and opening of the valve. The receiver may have a finely adjustable cock or valve upon the gas-supply pipe from the main, and a pressure-indicator so that irregularities in the actual pressure in the main may be prevented from affecting the desired uniform pressure in the receiver. Or an automatically acting reducing-valve or governor may be introduced between the main and the receiver, in order to maintain a constant pressure in the latter. Further, the inlet-valve from the receiver to the mixing chamber is mechanically operated by a cam on a rotating shaft of the motor; and the periphery of the cam is so arranged that, with a constant pressure in the receiver, the inlet-valve is held more or less open, according to the suction effort of the indrawing piston of the motor, in order that the velocity of the gas through the inlet-orifice into the mixing chamber may bear a constant ratio to the velocity of the air through its inlet-orifice.

Generating Combustible Gases.—Thwaite, B. H., of Great George Street, S.W. No. 8384; April 21, 1896.

This invention relating to the generation of combustible gas, more particularly applies to the apparatus for which the applicant has already obtained several patents, and the object of which is the production of gas, intended for driving gas-engines, from inferior hydrocarbonaceous fuel. The former patents to which this invention relates are No. 13,385 of 1884 and No. 18,445 of 1894. In the first-named one, two associated vessels are shown to have an air supply applied over the surface of the fuel. The action of final gasification in the present generator is a descensional one; but the partial and initial combustion of the fuel is effected in an associated generator; and a secondary combustion is effected by the introduction of air above the solid fuel level. The effect of this combustion (described in the specification referred to) is the generation of a considerable degree of heat; and in order to reduce this loss, the patentee now proposes to encase the whole of the generator sides of both vessels with water chambers, so constructed that they will stand a considerable pressure—the steam thus generated being employed as an agent to increase the calorific intensity of the gas produced.

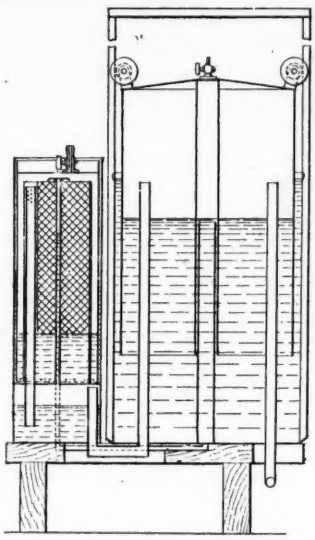
Sewer-Ventilating Lamps—Holman, S., of South Kensington, W. No. 8532; April 23, 1896.

This is a modification of the patentee's previous inventions—No. 20,781 of 1892 and No. 20,881 of 1894—the object aimed at being to render the arrangement safer by providing means for preventing all danger of "back-firing" of the gases. The furnace, within the apparatus at the top of the pipe leading from the sewer, is generally like that described in the 1894 patent; but the sections which are placed together to form the vertical passages for the uprising sewer gases, receive the gases only—there being no provision for the products of combustion joining the gases at the lower part of the vertical passages. In the crown over the tubular extension leading from the burner of the furnace is made an orifice, over which is placed an inverted cap, leaving a space between its edges and the crown for the escape of the products of combustion from the burner, to meet the sewer gases rising from the top of the vertical passages. The gases from the sewer are not allowed to come into contact with the flame of the lamp at the top of the pedestal through which they pass, in consequence of the exit-tube for the gases and products from the furnace beneath extending up through the lantern. The burners of the lamp are preferably of two kinds—one for illuminating and the other for heating effect—with a three-way gas-tap, by which gas can be turned on to one or the other as desired. The heating-burner may be on an ordinary atmospheric gas-ring surrounding the exit-tube, and may be used in the daytime; while the burners for illuminating may be on another ring for use at night time.

Generating Acetylene Gas.—Fourchotte, M. C. A., of Paris. No. 12,047; June 2, 1896.

This apparatus for the production of acetylene gas (in quantities proportionate to the consumption of the gas) by decomposing calcium carbide by water, comprises a generator proper and a gasholder, placed side by side. The generator consists (as shown) of a receiver open at the top, and containing water. Above the water-level within the receiver, is placed a perforated basket to receive the carbide. A bell-shaped cover descending to the bottom of the receiver is also provided, and is sufficiently loaded to form with the water a hydraulic seal. From the upper part of the carbide vessel, a tube passes which communicates with a tube rising in the gasholder to nearly the level of the water; and around this latter tube another tube fixed to the bell of the holder slides.

The consequence of this arrangement is that, when the bell of the holder descends, the air or gas contained in the tube fixed to the bell becomes compressed, and exerts a pressure upon the water which is contained in the inner tube of the holder. Thereupon the water is forced back into the tube of the generator, and is caused to flow on to the carbide and generate more acetylene, which passes into the holder, and causes the bell to rise again. The pressure in the tube of the holder is thus diminished; and the water re-ascends in the tube, and ceases to come in contact with the carbide.



A special device prevents the acetylene contained in the bell from returning to the generator. For this purpose, a reservoir arranged beneath the generator is filled with water to a certain height. The upper part of the reservoir above the water-level is placed in communication with the interior of the bell-shaped cover of the holder, by means of a pipe. At the top of the generator, where the acetylene is disengaged, a tube terminates, which reaches into the water of the reservoir, and through which the acetylene is discharged. By these means, the gas produced in the generator is forcibly agitated and washed in the water of the reservoir before it arrives at the tube which conveys it to the holder; and the water of the reservoir thus constitutes a hydraulic seal, which prevents the gas flowing back.

The time during which the water flows upon, or comes in contact with, the carbide can be regulated by means of a cock provided at the upper end of the tube of the bell. In the tube a pressure may be maintained equal to that existing in the bell, as long as no water comes in contact with the carbide; and it is sufficient for this purpose to pierce it with holes to a fixed height. As long as the holes are above the level of the water, the pressure will not increase in the tube of the bell during the descent of this latter; but as soon as the holes lie to a certain extent below the water-level, the pressure will increase in the tube of the bell, and the water will be forced back on the carbide. Holes may also be provided in the tube of the holder, in order to fix the exact point at which the immersion of the bell will cause the water to flow on to the carbide.

Laboratory Gas-Burner.—Lamplough, F., of Glen Ridge, New Jersey, U.S.A. No. 12,455; June 6, 1896.

The induction gas-burner is intended to take the place of the ordinary bunsen burner in laboratory and general work, as well as the ordinary gas-blowpipe used in various descriptions of mechanical work. The idea forming the basis of the invention is "the induction of a large current of air by means of a fine jet of gas." This principle is already utilized in the bunsen burner; but in such cases, unless the gas is kept full on, it loses its velocity—in other words, in reducing the flame of a bunsen burner by means of the gas-supply cock, the velocity of the gas is impeded by being wire-drawn through the plug of the cock. The consequence is that, in burning under these conditions, the gas in rising carries with it an amount of air which (unless the burner-nozzle is of sufficient length) causes it to "light-back."

The patentee proposes to employ, as heretofore, a nozzle which may be varied in bore according to the work it has to perform. The lower end of the nozzle enters an air-chamber, provided with holes below the centre around the circumference of it. The gas-jet nipple rises somewhat into the air-chamber, and is provided with a needle-valve. Thus, by the gas stopcock being left full on, and the jet-nipple orifice being regulated by a needle-valve, the current of gas induces air to enter the air-chamber, and to travel at high velocity through the nozzle. The velocity of the gas escaping at this point is kept constant—merely the stream of it being varied—with the result that the burner does not light-back, and a good current of air is continually sent with the gas through the nozzle; the size of flame varying according to the amount of gas used.

Rendering Acetylene Gas Inactive in Contact with Certain Metals.—Isaac, G., of Charlottenberg, Germany. No. 15,139; July 8, 1896.

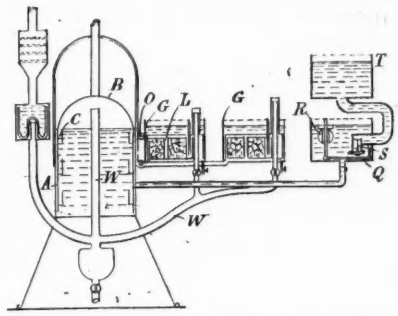
The patentee points out that, as is well known, solid compounds of a highly explosive nature are formed immediately acetylene gas is brought into contact with copper, silver, or quicksilver, or their alloys, and which solids can be easily made to explode by being hit or heated. It is his view that the reason acetylene becomes explosive when brought into contact with the metals mentioned, is that the gas, as a rule, contains a considerable amount of aqueous vapour, arising from the present method of producing the gas from carbide of lime and water. The amount of aqueous vapour contained in acetylene makes the latter chemically more effective; and possibly the water also plays a chemical part, in aiding in the necessary

conversion of the copper into oxide of copper for forming acetylene copper by means of the amount of oxygen it contains. But, be this as it may, it is a fact that the property of forming explosive compounds is completely taken away from ordinary acetylene gas saturated with steam, by the water being drawn away from it by means of a drying agent—such as concentrated oil of vitriol, calcium chloride, or phosphoric acid-anhydride.

The patentee has also found that ordinary acetylene gas always contains ammonia, which likewise aids the formation of the explosive compounds. It is, therefore, preferable to remove this body also from the gas; and the simplest way of doing this is to use concentrated oil of vitriol serving to dry the gas. In consequence of the proportionately not inconsiderable quantity of ammonia contained in raw acetylene, sulphate of ammonia can be obtained where sulphuric acid is used for absorbing purposes. Seeing, however, that raw acetylene (for reasons easily explained) also usually contains sulphide of hydrogen, which is decomposed by sulphuric acid in separating the sulphur, it is preferable, in order to obtain as pure a sulphate as possible, to first remove the sulphuretted hydrogen gas—preferably by passing the raw acetylene through finely powdered iron ore.

Producing Acetylene Gas.—Trendel, F., and Mücke, J., of Berlin. No. 139; Jan. 2, 1897.

This invention relates to a process "for producing acetylene evenly, with a constant small after-production," by arranging calcium carbide in porous form in such manner that it always offers to the water a large, free surface of contact, with but slight depth; while the contact of the water with the carbide takes place from the bottom, gradually rising upwardly.



The apparatus shown consists mainly of a water-reservoir A working in which is a gasholder bell B with buckets C and a central guide-rod. The gas-generators are marked G and G¹, having water pipes and cocks for the outlet and inlet of water, &c. The gas-pipe system W leads to the gasholder bell and the point of consumption.

In order to set the apparatus at work, a cartridge of carbide of calcium is placed in the generator G, the bell of which is covered over and the water-inlet O opened. Hereupon water is discharged from the reservoir T to the reservoir Q, and to the cistern A—rising in the receptacles Q A G until the water-level in these three receptacles has reached the height regulated by the float and valve R S, whereupon the valve will close the water-inlet.

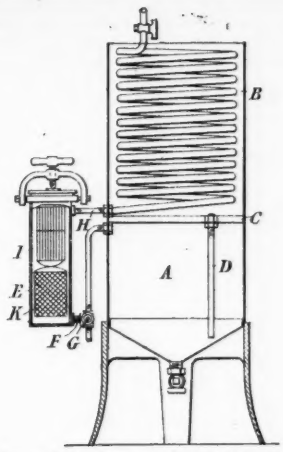
The water rising in the generator G will force the air out through the syphon C, which is so arranged as to form a water closure, shortly before the water has risen sufficiently to enter the cartridge inlet; and thus the disadvantage is obviated of having to drive the air out of the bell of the generator G along the pipe system to the gasholder bell. If the gas-cock is now opened, the water will enter the cartridge, and the generation of acetylene gas will begin. The gas, on leaving the cartridge at L, flows to the gasholder B, in so far as it does not pass directly to the burners through the dryer and the purifier X. The pressure of the gas produced in the pipe system will be regulated, as long as the gas is being consumed, by the height of the water column in the generator G above the inlet-opening of the cartridge; and in order to keep this pressure constant, the cistern Q, with float and float-valve R S, is provided, which regulates the water-feed from the reservoir T.

Producing and Storing Acetylene Gas.—Holliday, T., of Huddersfield. No. 885; Jan. 12, 1897.

This apparatus for generating and storing acetylene gas consists of a displacement gasholder, and an exteriorly arranged generator; the latter being from its upper part directly in connection with the service-pipe, and from its lower part (below the level of the carbide) in connection with the upper part of the holder.

The holder A has a water-cistern B above it, but separated from it by a horizontal partition C. A pipe D passing through this diaphragm, and extending down to near the bottom of the holder, connects the cistern with the holder. The generator E is fitted to contain the carbide of calcium placed in a removable perforated cage. The lower end of the generator is connected to the top of the holder by the pipes F fitted with a three-way valve G. A gas-delivery pipe H is connected to the top of the generator, and preferably coupled to a cooling coil in the cistern B.

To put the apparatus into operation, the holder A is filled with water, and a little water is also placed in the cistern B. The generator is next charged with calcic carbide placed in the basket-cage I. This basket-cage I is of a somewhat smaller diameter than that of another basket-cage K, which occupies the lower part of the generator. The latter is made of wirework sufficiently fine to retain the lime or other material employed that may fall from the upper cage I, while yet allowing the water to drain through. After the lid of the generator is secured, the valve G is turned so that the water from the holder flows into the generator as air or gas is withdrawn through the service-pipe; and the generation of gas commences. In case the gas is generated faster than it is required, it first accumulates in the generator, and drives the water back into the holder. After this, any gas generated in excess of what is immediately required also passes into the holder, and, displacing



the water therein, forces it up by the pipe D into the cistern B. This gas remains in the holder until the consumption of gas exceeds the speed of generation, when such gas passes from the holder through the generator to the pipe H. As the pipe F is coupled to the holder at its highest point, water is not again admitted to the generator until the gas accumulated in the holder is practically exhausted.

Lighting and Extinguishing Gas-Burners.—Boult, A. J.; a communication from B. Jolles, of Vienna. No. 905; Jan. 12, 1897.

The characteristic feature of this device to enable gas-burners to be lighted or extinguished from a place at any desired distance from the burner, is that the valve for the admission of gas is opened by an electro-magnet, and is held open by a pawl-device till the latter is operated to release the valve by another electro-magnet placed in an independent circuit. The opening and closing of the gas supply is accomplished in this manner; and the lighting of the gas escaping from the burner is effected either by an incandescent igniting device of platinum-wire or spongy platinum, or by a spark-igniter placed in a third (independent) circuit.

Production of Acetylene.—Daix, V., of Paris. No. 911: Jan. 13, 1897.

This invention relates to apparatus (working intermittently or continuously) for the production of acetylene gas, in which the supply of water to the calcium carbide is regulated by water syphons or mercury cups, in accordance with the variations in the consumption of gas, and in which the mass of the carbide to be decomposed is divided and placed in vessels arranged in a central compartment, provided with overflows enabling the water from the upper vessel to be discharged into the vessel immediately below. This central compartment is surrounded by a water-chamber, in which the acetylene produced is washed and cooled—passing, if desired, through a tubular coil before entering into the gasholder, to the bell of which is attached a device to regulate the supply of water used for the decomposition of the carbide.

Generator for Acetylene.—Des Essards, E. H. F., of Paris. No. 1153; Jan. 15, 1897.

The claim made for this invention of a gas generator for automatically producing acetylene or other gas resulting from an analogous reaction, is for the combination of two receptacles—one of which contains the reducing or dissolving liquid, and the other the body to be reduced or dissolved—with an intermediate chamber or bulb, interposed between the two receptacles, and into which two concentrical tubes of different lengths project. Any other arrangement for obtaining a constant level—such as two non-concentrical tubes, one single tube or the like leading from the upper receptacle—may also be employed. From this intermediate chamber a tube, provided with a cock and a valve, passes into, and terminates within, the lower receptacle, for the purpose of enabling the liquid to produce the reaction, and consequently effect the automatic disengagement of gas at constant pressure.

Automatically Operating Gas-Burners.—Heymann, E. & F. W., of Boston (Mass.), U.S.A. No. 2752; Feb. 2, 1897.

This invention relates to burners of the class automatically operated by the withdrawal of the heat they engender to close a valve controlling the outflow of gas from the burner.

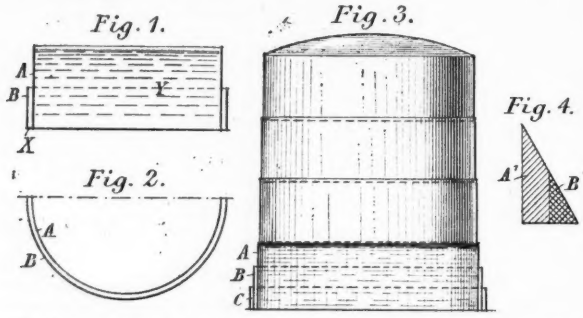
The burner is provided with a chamber in direct communication with the gas-supply pipe, and with an outlet-passage adapted to communicate with this chamber through a port controlled by a valve automatically operated by a thermostat, which, when heated, removes the valve from its seat, and so permits the gas in the chamber referred to, to flow to the tip or burner proper. When, however, it is not heated, it seats the valve and cuts off the supply of gas from the tip—the valve when seated being acted upon by the pressure in the supply-pipe to more effectually close the valve. The thermostat, is preferably made of aluminium and steel strips, secured together by rivets, and fastened at one end to the burner-tip, and having its other end in engagement with the valve, while being protected from injury by a covering.

Gasholders and Liquid Reservoirs.—Kelting, R., of Aachen, Germany. No. 4676; Feb. 20, 1897.

The patentee claims this as his invention: "A gasholder or liquid reservoir, the walls of which are reduced in thickness to the lowest limit by surrounding the reservoir with one or more walls decreasing outwardly in height, so that the liquid or other filling substance placed in the annular spaces thus formed, counterbalances the increasing static pressure within the enclosed reservoir to the extent of the height of the enclosing reservoir."

Alluding to his invention, he says: In constructing large receptacles of sheet metal, such as are intended to serve as water reservoirs—and more

especially as water-tanks for gasholders—the thickness of the metal required rapidly increases to such an extent that the construction is rendered practically impossible. A diameter of 50 metres, and a height of 10 metres, for such reservoirs represent about the maximum dimensions obtainable in the construction with such sheet metal. In cases where these dimensions were insufficient, it has hitherto been necessary to construct such reservoirs of beton or masonry. The object of this invention is to so construct gasholder or liquid reservoirs, that the difficulties mentioned are obviated.

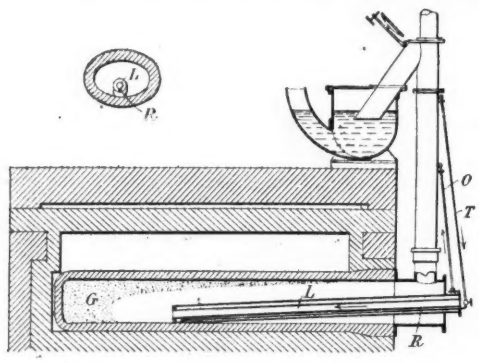


The invention is illustrated by drawings, in which fig. 1 represents a central section through a liquid reservoir; fig. 2, one half of the reservoir in plan; fig. 3, another constructional form of the reservoir in elevation; and fig. 4, a graphic representation of the hydrostatic pressure to be taken into consideration in calculating the thicknesses of the wall to be employed.

According to this invention, a second wall B is so arranged around the inner wall A, that its highest part is level (or nearly level) with the highest point of maximum thickness of the inner wall. The annular space X formed between the outer and inner wall is filled with liquid; so that below the level of the liquid in this annular space the hydrostatic pressure upon the inner wall does not increase, because the pressure increasing toward the bottom of the inner space Y is counterbalanced by a similar increasing pressure within the annular space X. Therefore, from the level of the liquid in the space X downward, the wall A may be constructed of uniform thickness. If this bi-partite wall still involves the use of sheet metal of excessive thickness, a further partition of the pressure may be made by providing a further exterior wall C (fig. 3), arranged so that its upper part is level with the point in the wall B where the thickness of the sheet metal is no longer sufficient for the pressure upon it. In fig. 4 the light-shaded surface A^1 represents the portion of the hydrostatic pressure which acts upon the wall A, and which pressure must be resisted by the wall. The cross-shaded triangle B^1 represents the portion of the pressure which, by the liquid in the annular space X, is transmitted from the inner wall A to the outer wall B. In this arrangement (which allows of the construction of large gas and liquid reservoirs by using wrought iron), any filling substance may, of course, be employed to replace the liquid, for the transmission of the pressure to the outer walls.

Removing Carbon from Gas-Retorts.—Roedel, A., of Worms, Germany. No. 5149; Feb. 25, 1897.

The process forming the object of this invention consists in introducing cold air into the retort, through a pipe having a cold water or other cooling-jacket; the cold air being passed through to the extreme interior of the retort—passing over the hot graphite, and being conducted off by means of a pipe. The result is that the graphite will be sharply cooled down on the interior surface, while the surface adhering to the walls of the retort remains very hot. The graphite thus partially cooled will contract unevenly, crack, and fall off the walls of the retorts in pieces.



As shown in the engraving, the tube introduced into the retort is provided with a cooling-jacket; the pipes being detachably connected, so that they may be taken apart to clean off the scale. Fresh air passes through the tube L to the rear end of the retort. The rear ends of the interior and exterior tubes are connected by means of a ring; while the front ends are fixed together by flanges. Between the walls of the double tube thus formed, a pipe R, having a cock on it, is arranged to extend from the cold water-inlet pipe T to the rear end of the retort. O is the pipe through which the water is led from the cooling-jacket.

When in operation, the air, which is cooled along the whole length of the tube L, passes out at the rear end, and back through the retort along all the walls of it. It thus rapidly cools down the inner surface of the carbon G, which cracks and falls off the walls of the retort, so that it may be easily removed.

Acetylene Producing Lamps.—Lake, H. H.; a communication from V. Hanotier and G. Hostelet, of Chimay, Belgium. No. 24,558; Nov. 3, 1896.

This lamp comprises a water receptacle separated from the remainder of the apparatus, and communicating with the carbide receptacle only through the shorter branch of a syphon. The longer branch of the syphon is at the same time much wider than the short branch; and its upper end is curved inwards. At the lower extremity of the lower branch, and at a certain distance above the bottom of the syphon, there is a little opening; and in its upper part, where it goes through the water receptacle, this longer branch is surrounded by a mantle—an annular space being left between the branch and the mantle, which goes through the top of the water receptacle, where it widens out into a recess, on the top of which is screwed the burner. The burner has three orifices (or consists of three burners), each provided with a particular cock. The two principal burners are symmetrically disposed, to make their flames meet at an angle, and form one large flame. The third burner is provided with one of large size, the opening of which is situated below those of the other burners. A tube reaches down into the longer branch of the syphon; its lower extremity being immersed in the small quantity of water which reaches up to the hole. The upper end of the tube communicates with a hollow sphere, lodged inside the recess, and communicating with the third burner (called the safety burner). A valve, the spindle of which is wormed at the top and screwed into the top of the water receptacle, fits into the upper opening of the shorter syphon branch, where the branch opens into the water receptacle. The receptacle is provided with a wire network reaching downward, and surrounding the carbide receptacle. Two conically-shaped wire gauzes are fitted on to the bottom of the water receptacle; and the baskets thus formed may be used as receptacles for lime, to dry and purify the gas before it is used, and to intercept tar and other impurities. The water is put into the receptacle through a hole at the top, protected by a cap, having a small hole drilled into it; a disc of leather or india-rubber being fixed inside, to keep dust out, though it will let air in.

Manufacture of Combustible and Illuminating Gas.—Mewburn, J. C.; a communication from F. G. Bates, of Philadelphia, U.S.A. No. 26,261; Nov. 20, 1896.

This invention relates chiefly to improvements upon the Lorois process for making combustible gas, and consists in forcing heated air and superheated steam through a mass of incandescent fuel in the producer chamber, wherein is maintained a pressure of at least 42 lbs. per square inch, whereby "producer gas is formed under so high a temperature as to avoid the formation of ammoniacal and tarry impurities, and the gas is hence so pure as to require no washing, scrubbing, or other purification to adapt it for use." The process referred to is the invention of Maurice Lorois—patent No. 16,413 of 1892. The present invention also introduces certain improvements in the motive power apparatus disclosed in the same patent. The objects arrived at are "to produce a gas of greater richness and higher value for heating purposes, such as the feeding of furnaces; to produce an illuminating gas of high quality; to improve the apparatus, and thereby facilitate the conduct of the process; and to provide means for economizing expense in the manufacture by using otherwise waste heat as a source of power."

The specification of the invention—extending to some thirteen pages of print, with twenty-six claims—is not describable apart from the eight sheets of drawings by which it is accompanied.

Water-Meters.—Meinecke, H. & P., of Breslau, Germany. No. 26,859; Nov. 26, 1896.

This invention relates more particularly to meters of the kind known as Thomson's water-meters; and the object in view is to prevent damage by frost to the works of such meters. To effect this, an internal casing containing the disc is arranged in such a manner in the interior of the main casing as to obtain a water-tight space underneath the internal casing, and adapted to be moved downward through the expansion of the ice, and thereby deform the thin bottom plate of the main casing and force the bevelled edge of the plate off the seat on its supporting ring.

APPLICATIONS FOR LETTERS PATENT.

10,988.—Collin, F. J., "Apparatus for cooling and washing gases.' May 3.

11,006.—Erikson, J., "Indicating the escape of unconsumed gas from gas-burners and the like." May 3.

11,117.—Welch, W. H. I., "Overhead gas-lamps." May 4.

11,130-1.—Humphreys, A. C., and Glasgow, A. G., "Manufacture of carburetted water gas." May 4.

11,210.—Proft, L. de, "Treating mantles for incandescent gas-lighting, to render the same flexible or supple." May 5.

11,229.—Glover, R. T. & J. G., "Coin-freed gas-meters." May 5.

11,252.—Abeele, F. Van den, "Supplying incandescent gas-burners with gas under pressure." May 5.

11,253.—Alexandre, H. E., "Gas-burners." May 5.

11,334.—Vaughan-Sherrin, J., "Electric ignition devices for gas-engines." May 6.

11,352.—Blanc, F. N., "Burners for acetylene gas." A communication from R. Türr. May 6.

11,364.—Lea, J. W., and Perrins, J. H., "Incandescent burners." May 7.

11,392.—Masterman, C. E., "Atmospheric gas-burners." May 7.

11,428.—Thomas, T. C. J., and Still, W. M., "Gas-lamps." May 7.

11,493.—Helps, G., "Improvements in the manufacture and construction of retorts, and in the construction of retort beds or ovens." May 8.

11,532.—Checinski, A., and Norberg, A., "Fluid meters." May 8.

New Water-Works for Shanklin.—The Local Government Board have under consideration an application by the Shanklin District Council for a loan of £6670 required for the purpose of augmenting the water supply of the town. The water is to be drawn from a field at Wroxall; and £1600 of the money will be spent in laying a main from thence to Shanklin for the conveyance of the water. An inquiry into the Council's proposals has been held by Mr. W. O. E. Meade King.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Theory of the Luminosity of Flame.

SIR,—I have read with much interest Professor Smithells's criticism of Professor Lewes's ingenious theory of luminosity, and regret that, owing to the absence of its originator, no defence was made. Probably we shall not have to wait long for this. In the meantime, I trust it may not be considered *inapropos* if I call attention to two matters which have appeared to me to be worthy of attention although not dealt with by Professor Smithells.

It would be interesting to learn whether carbon is present in any form at the spot in a flame just before luminosity commences, other than as "2 per cent. of unsaturated hydrocarbons—80 per cent. of which is acetylene." For if not, then whether Professor Lewes be right in maintaining that the luminosity of flames is largely due to the endothermicity of acetylene, or Professor Smithells, in maintaining that the flame temperature is sufficient of itself to endow carbon particles with incandescence, we still have an acetylene theory of luminosity.

Professor Lewes, in replying to a former criticism of Professor Smithells (see "Journal of the Chemical Society," January, 1896), laid stress upon the fact that the temperature necessary to decompose acetylene with luminosity is insufficient to raise the carbon liberated from it to the point at which it emits light. This argument has always appeared to me to be, to a certain extent, fallacious. The carbon at the moment of liberation would be in the molecular condition; but the molecules would quickly coalesce to form carbon particles. It may, therefore, be argued that, though the temperature of the tube used in Professor Lewes's experiment might be sufficient to endow with luminosity carbon molecules, it would be insufficient to confer it upon carbon particles—the latter perhaps being a million times the size of the former.

E. LLEWELLYN PRYCE.

Adderley Street Gas-Works,
Birmingham, May 15, 1897.

Mr. Lewis's Paper on the Recovery of Cyanogen.

SIR,—In the interesting paper which Mr. G. P. Lewis read before the Institution of Gas Engineers at their recent meeting in London, it was stated that the quantity of hydrocyanic acid found in crude coal gas varied considerably with the different temperatures of carbonization employed. No doubt this to a certain extent is so; but I have found, as probably have others, that there are many other factors which also tend to make a difference in the yield of this acid. My experience is that different classes of coal, methods of manufacture, and the numerous variable local conditions very materially affect this. In some cases, it would almost appear to me that the temperatures above a certain point have little to do with the yield, though Mr. Lewis stated that the yield was greatest with the highest temperatures, which view Dr. Coleman also bore out, with, however, the extensive stipulation, "other things being equal."

Upon my return to Huddersfield, I turned up some tests I have made here with a view of confirming my impression as to the temperature question; and I find at these works, where the yield of gas per ton of coal carbonized is somewhere about 10,000 cubic feet, I have only been able to obtain at the most 2½ lbs. of the crystallized salt per ton of coal; the temperatures of the retorts during the test being from 1700° to 1800° Fahr. Without giving names, I have spoken to managers of other gas-works who have been experimenting in the same direction in neighbouring towns, who have also been carbonizing with heats very nearly similar to those employed here; and I have ascertained that the yield of hydrocyanic acid obtained by them has been even lower than that realized here. On the other hand, at an important chemical works where a large coal-gas plant is worked simply for the recovery of the bye-products, and the heats used are considerably lower than those employed in gas-works where gas is made primarily for illuminating purposes (the yield of gas per ton of coal carbonized barely reaching 8000 cubic feet), the amount of ferrocyanide obtained has been from 5 to 5½ lbs. per ton of coal.

As the subject is one of considerable interest at the present moment, it would be useful to know what amount, under different temperatures, has been obtained by others who have been experimenting in this direction; and I feel sure that you would allow them to give this information through the columns of the "JOURNAL." Apart from the scientific question, is it possible that we, as manufacturers of gas, have a bias towards high heats, and, knowing the increased yield of gas per ton obtained with these, are expecting, along the same lines, the greatest yields of hydrocyanic acid with the highest heats? In the matter of residuals, however, I believe it to be a general experience, upon a manufacturing scale, that low heats are favourable to the yield of tar, ammoniacal liquor, &c. If for these, we might argue, why not for the cyanides?

I do not think the argument that cyanogen is obtained as a bye-product, whether wanted or not, is of much importance, as the quantity of ferrocyanide, &c., obtainable per ton of coal is the basis upon which all calculations of saving must be made. Mr. Foulis pointed out that he believed a works had recently been started for the purpose of producing cyanide from the nitrogen of atmospheric air, which certainly opens up large possibilities in that direction.

EDWARD A. HARMAN.

Huddersfield, May 12, 1897.

SIR,—In the discussion on Mr. Lewis's paper on cyanogen recovery at the recent meeting of the Institution of Gas Engineers, there appears to have been some confusion between cyanides and ferrocyanides. To quote one important instance, Herr Voissen is reported to have said that the total consumption and production of cyanides (for 1896?) had been 7500 and 6000 tons respectively. To those who are familiar with the figures, it is obvious that they refer to ferrocyanides, and not to cyanides. The consumption of cyanides (K Cy and Na Cy) is estimated at from 1900 to 2300 tons, or about a third of the ferrocyanide figures.

The paper and the discussion raise a number of interesting practical questions, to some of which I should like, with your permission, to refer next week.

GEORGE BEILBY.

St. Kitts, Slateford, N.B., May 14, 1897.

The Work of the Tar Distillers' Association.

SIR,—In your issue of the 4th inst., you report (p. 999) an application which was made before Vice-Chancellor Hall in the case of *Hardman and Holden Limited, v. Lockwood and Co.*, during the hearing of which the defendants alleged that the plaintiffs were the nominees of the Tar Distillers' Association. Your report further states that the defendants said the Tar Distillers' Association was "an illegal Association; and in carrying out its objects, the members were guilty of a criminal conspiracy." My attention having been called to your report, I, as the Secretary of the only Association of Tar Distillers known to me in England, wish to make the following statement: That the Association of Tar Distillers, whose headquarters are at the London Chamber of Commerce, Eastcheap, London, never has, directly or indirectly, interfered with, or influenced in any way, any contract for tar; and consequently the Association of Tar Distillers never has in any way been mixed up with the dispute between Messrs. Hardman and Holden, Limited, and Messrs. Lockwood and Co. I enclose copy of our rules.

ALEC. FORREST.
Hon. Sec. Association of Tar Distillers.

Botolph House, E.C., May 12, 1897.

[ENCLOSURE.]

The rules enclosed in our correspondent's letter set forth, among other things, that the Association has been established to discuss all matters connected with the tar trade, and to facilitate the interchange of information among the members. These consist of partners, directors, managers, secretaries, or responsible employees of firms engaged as tar distillers; and the affairs of the Association are managed by a Committee subject to the control of the general meetings. The Committee consists of the representatives of seven firms, who may send any of their representatives, being members of the Association, to deliberate at Committee meetings; but the voting is by the firms—each having one vote.

A Bunsen Burner for Acetylene.

SIR,—The paragraph on p. 1056 of the last number of the "JOURNAL" is a little misleading. Any *small* bunsen burner of the ordinary type works satisfactorily with acetylene gas without alteration; but as this gas, even with a slight admixture of air, is very explosive, none but burners of small diameter can be used. The ordinary ⅛ or $\frac{3}{16}$ inch bore burners made for sealing small parcels, such as are commonly seen in use in chemists' shops, work very well. The flame is steadier, and less liable to be interfered with by draughts, if the tube is made rather longer than usual; but any addition to the length makes a heavier pressure of gas necessary, owing to the greatly increased friction in the tube.

THOS. FLETCHER.

Warrington, May 13, 1897.

SIR,—On p. 1056 of your last issue, you describe a bunsen burner exhibited at the Chemical Society by Mr. A. E. Munby, M.A., which appears to be made in accordance with my patent, No. 12,744 of 1895. My specification states: "The special feature of the burner being that the gas issues from minute orifices in fine jets having a high velocity and a powerful inductive action on the air."

A. CLARKE.

161, *Albion Road, N., May* 13, 1897.

Recovery of Water-Rates by Statutory Companies.

SIR,—Is not the reply to Mr. White (whose letter on the above subject appeared in your last issue) that he mistook his remedy? The Police Court is not a court of competent jurisdiction in such a case. Proceedings should have been taken in the County Court or the High Court, according to the amount of the claim (see Water-Works Clauses Act, 1863, Sec. 21). If I correctly understand the position, the Police Court did not adjudicate upon the claim for more than six months' rate because its jurisdiction was ousted by statute. Mr. White would therefore appear to be at liberty still to take County Court proceedings for the amount which the Police Court could not order to be paid.

H. WILKINS.

Lambeth Water-Works, May 13, 1897.

Lowestoft Corporation and the Water and Gas Company.—The Directors of the Lowestoft Water and Gas Company have declined to meet a Committee of the Corporation in reference to the Company's Bill; and the Corporation are therefore taking the necessary steps to oppose it.

The Dangers of Unventilated Gas-Geysers.—The case of the young woman who, as recorded in the "JOURNAL" a fortnight ago, was found dead in a bath-room which had been recently fitted with a gas-geyser, but without proper ventilation, has been taken up by one of our medical contemporaries. The writer thinks that, so far as the Metropolis is concerned, the wording of the Public Health (London) Act, which expressly includes under the word "nuisances" matters "dangerous to health," is sufficiently wide to include any gas-geyser so fitted as not to effectually carry all unconsumed gas and products of combustion out of the bath-room. If this view is correct, it is the duty of the sanitary officers to treat such matters which come under their observation as nuisances to be abated in the ordinary way.

The Profits of the Sowerby Bridge Water Department.—The Sowerby Bridge District Council have had a statement prepared in regard to the "extra expenditure" taken from the water-works profits in the last ten years; and it is interesting as showing that the money has all been spent for the benefit of the department and consumers. The total is £8755; and the following are the component items: Lowering of the charge for water (by discounts) in 1890, £2036; laying new mains, valves, and hydrants in new streets and other extensions, £761; taking up and re-laying old mains, £122; cost of opposition to the Halifax Water Bill (by which the cost of water was reduced from 6d. to 5d. per 1000 gallons), £787; increased balance on revenue account, £804; amount set aside to pay off borrowed capital (sinking fund), £3544; and rent charge of fire-plugs discontinued, £700. The amount taken from the rates during the same period was £2700; and, deducting this from the £8755, left a total surplus of £6055, or an annual average of £605. The average consumption of water of 51 surrounding towns and districts for domestic purposes, not supplied through meter, and covering all leakage, is 22 gallons per head per day, as against 10½ gallons for Sowerby Bridge.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill read the first time and referred to the Examiners: Clackmannan (Alloa and Tillicoultry) Water Supply Provisional Order Bill.

Bills read a second time and committed: Arundel Gas Bill, Ashford Urban District Gas Bill, Devonport Water Bill, Luton Water Bill, Pwllheli Corporation Bill, Tuxford and District Gas Bill.

Bill reported (preamble not proved): Eastbourne Corporation Water Bill.

Bills reported, with amendments: Chichester Corporation Water Bill, Eastbourne Water Bill, Fylde Water (Transfer) Bill, Hunstanton Water and Gas Bill, New Hunstanton Water and Gas Bill, Perth Improvement Bill.

Bill read the third time and passed: Edinburgh Corporation Bill.

The Crowborough Water Bill has been referred to a Select Committee, consisting of the Earl of Crewe (Chairman), the Earl of Rosse, Lord Clonbrock, Lord Mostyn, and Lord Pirbright; to meet on Wednesday, May 19.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Borrowstounness Water Provisional Order Bill, Local Government Provisional Order (Gas) Bill.

Bill read a second time and committed: Cirencester Water Bill.

Bills reported: Colne Corporation Bill, East Warwickshire Water Bill, Llandudno Urban District Council Bill, Newark Corporation Water Bill, Nottingham Corporation Water Bill, Swadlincote District Gas Bill.

Bills read the third time and passed: Loughborough Corporation Bill, Taunton Gas Bill, Torquay Corporation Water Bill.

Last Thursday, Mr. Gray, in accordance with notice, moved—"That it be an instruction to the Committee on the East London Water Bill that they have power to insert a clause providing that the term 'the annual rateable value of the tenement supplied with water' shall have the same meaning in the districts outside the Metropolis supplied by the Company as the term now has within the Metropolitan area." He contended that no wrong could possibly be inflicted on the Company by determining that the same rates should prevail outside as well as within the Metropolis. Colonel Lockwood and Mr. Banbury spoke in opposition to the motion. Mr. Chaplin said he understood that the view of the Company was that their Bill was to supplement one sanctioned last year. That Bill gave greater storage power to the Company, so as to obviate the risk of a recurrence of the water famine. In order to enable the Company to carry the Bill into effect, the present measure was said to be necessary. An instruction was now moved which the Company alleged might be extremely injurious to them; and his hon. friend asked that the Committee should be empowered to consider and discuss the question involved in it. He did not think adequate reason had been shown for adopting the course proposed. The matter, if dealt with at all, should be dealt with in relation to all the Water Companies, and a Public Bill ought to be introduced for the purpose. In the circumstances, he did not think the House would be well advised in passing the instruction. Mr. Gray said he realized that it would be perfectly futile to press the motion to a division in the face of the right hon. gentleman's statement. He would therefore ask leave to withdraw it. This was granted.

HOUSE OF LORDS COMMITTEE.

EASTBOURNE WATER BILLS.

Two Bills relating to the water supply of Eastbourne—one promoted by the Corporation and the other by the Water Company—have lately been under the consideration of a Committee of the House of Lords presided over by Lord Fermanagh. The first-named measure was to authorize the Corporation to purchase the Company's undertaking, and to empower them to construct additional works and supply water within the borough of Eastbourne and adjacent places; the second was to sanction the making of additional works by the Company, and the raising of further capital to the amount of £100,000 by shares and £25,000 on loan. The inquiry opened on the 6th inst. with the Corporation Bill, which the Committee declined to pass. Last Tuesday, they inquired into the merits of the Company's Bill, which was opposed by the Corporation and by certain property-owners. The Committee, however, approved its principle; an undertaking being given by the Company to furnish a temporary supply of water from Friston by the 1st of August next, should it appear to Sir F. Bramwell (who is to confer with their Engineers on the matter) practicable to afford such supply. The Company had a strong array of expert witnesses ready to give evidence—including, in addition to Sir F. Bramwell, Mr. J. Mansergh, Mr. W. A. Valon, Mr. Rofe, Professor Dewar, and Mr. Whitaker; but the Committee stopped the inquiry. A report of the proceedings here summarized will be given next week.

COMMITTEE ON POLICE AND SANITARY REGULATIONS BILLS.

COLNE CORPORATION BILL.

This Bill, which is for the purpose mainly of enabling the Corporation of Colne to provide a better supply of water for the town, was recently before the above-named Committee. For hundreds of years Colne has been a seat of the woollen industry. In recent times, the growth of the town has been remarkable. In 1875, when the Local Board was constituted, the population was 9000, and the rateable value £28,000. At the present time, the population is estimated at 23,000, and the rateable value at £74,000. In 1895, Colne received a Charter of Incorporation, and became a borough. Between the dates named, the Local Authority acquired the gas and water undertakings. The supply of water now is 20 gallons per head per day. In view of future requirements, this is quite inadequate. The Corporation therefore propose to spend £110,000 on additional works; the water to be obtained from a stream in the neighbourhood, called the Wycoller Beck. By making some concessions in the matter of compensation water, they were able to satisfy the petitioners against the Bill, nine in number. In a report to the Committee, the Local Government Board pointed out that the Corporation debt amounts already to some £234,000, and that the Bill proposes to increase the borrowing powers to the extent of £142,000—an increase representing the assessable value of the borough for two years. The Corporation replied that the Local Government Board had not taken into account the fact that the town owned property worth nearly £200,000—viz., gas-works, representing £77,300; water-works, valued at £69,000; and sewage works, on which had been spent £53,000. Evidence in support of the Bill was given by Mr. G. H. Hill, M.Inst.C.E., and others. It was stated that the neighbouring township of Trawden, whence the additional supply of water is to be obtained, will be able, in case its interests so demand, to make a claim on Colne for a certain quantity of water. The Committee passed the Bill.

BOLTON IMPROVEMENT BILL.

This Bill, the object of which was primarily to enable the Bolton Corporation to construct additional tramways, and to use electrical or any mechanical power for the working thereof, and also to carry out certain improvements, came before a Committee of the House of Commons last Thursday. No objection was raised to the proposals of the Corporation as far as the tramways and improvements were concerned, but to the portion of the Bill relating to the supply of gas—the opposition being principally from the outlying districts of Horwich and Turton, where a differential price of 6d. per 1000 cubic feet is charged for gas, though the districts so closely adjoin the borough that it is impossible to separate them unless through knowledge of the actual boundary. On the Corporation becoming aware that the above-named districts, containing together from 23,000 to 25,000 inhabitants, intended to oppose them, and had retained the services of an engineer for the purpose, they at the last moment withdrew the gas clauses, with the consequence that they had imposed upon them the penalty of paying the costs of the opposition. This is a power which all Committees possess; but it is seldom exercised, except in cases like the present, where promoters of Bills have caused expenditure unreasonably. This they did in the case under notice, by first proposing to agree to a clause for purchase, then refusing to accept it, and finally withdrawing all the gas clauses from the Bill. Mr. W. A. Valon was retained for Horwich and Turton, and Mr. T. Newbigging for the Rural Sanitary Authorities outside those districts.

Writing on the above subject, our Bolton correspondent says: The withdrawal of the gas clauses in the Bolton Corporation Tramways and Improvement Bill has given rise to much comment; and the reasons which led to the promoters taking this step have been much canvassed in the district. The Bolton Rural District and the Urban District Councils of Turton and Horwich lodged petitions against the Bill; and it was anticipated that there would be a big fight over the gas clauses—the Councils named being strongly of opinion that they would secure an abolition of the meter-rents now charged to consumers outside the borough, as well as an alteration in the present differential price for gas—the charge being now 2s. 6d. net within two miles of the Bolton Town Hall, and 3s. net beyond that radius, except to consumers of more than 250,000 cubic feet annually, who are placed on the same scale as those inside the borough. All the other objections to the Bill had been withdrawn; but a small army of representatives of the four authorities concerned in the gas clauses journeyed to London in the early part of the past week to be ready for the Bill when it came before the House of Commons Committee on Thursday. At the last moment, the Corporation decided to withdraw the gas clauses and pay the costs of the opposing authorities, whose representatives were deprived of testing the legality of the Corporation having a differential price for gas and charging outside consumers meter-rent. By the clauses in question, the Corporation sought power to erect additional gas-works, and their insertion in the Bill gave the Rural District Council and the Urban District Councils of Turton and Horwich the opportunity for which they have been waiting for years, of fighting the larger authority on the gas charges. With the withdrawal of the gas clauses, the Bill was referred to the House of Commons Committee on Unopposed Bills. On the one hand, it is asserted that the Corporation were afraid to test the question, particularly in the face of recent decisions (notably Salford and Eccles); and on the other, it is said that the advisers of the Corporation decided to withdraw the clauses in view of a probable extension of the borough boundaries at an early date, coupled with the fact that the clauses were really of little importance to the borough, simply referring to the erection of about three purifiers near their works in Gas Street. But the question is asked: Why was this not done earlier, when it was evident that the neighbouring authorities were determined to fight the question of gas profits? It is anticipated that there will be a lively discussion on the subject at the next meeting of the Town Council.

Newark and Nottingham Water Bills.—Owing to the pressure on our space, we are compelled to hold over till next week the conclusion of the report of the proceedings on these Bills, both of which, as notified in our "Progress," have been passed by the Select Committee.

Heywood Corporation Gas Accounts.—The revenue account of the Heywood Corporation Gas Department for the past financial year shows receipts amounting to £17,818, which is a decrease of £756 compared with the previous twelve months. This was brought about by a reduction in the price of gas, and the decline in the value of residuals. The gross profit was £5873; and the net profit, £1104. Out of the latter amount the Gas Committee have decided to grant £500 for the relief of the rates, and to place the remainder to the reserve fund.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, May 10.

(*Before Baron* POLLOCK *and a Special Jury.*)

Fosh v. The Gaslight and Coke Company—The Liability for Personal Injuries through an Explosion.

This was an action for damages for personal injuries sustained by the plaintiff, a little boy nine years of age at the date of the occurrence, Sept. 16, 1895, by an explosion of gas under the pavement in St. John Street, Bethnal Green.

Mr. SALTER appeared for the plaintiff; Mr. DANCKWERTS represented the defendants.

It appeared that the boy was thrown down violently by the explosion, and sustained an injury to the head, which it was said had resulted in loss of memory and other troubles, as well as a compound fracture of the left arm caused by the iron cover of a water hydrant-box close to a lamp-post, in which the explosion took place, falling upon it. It was suggested for the defence that the plaintiff had himself brought about the accident by playing with fire; but this was denied by him and by two of his companions.

Mrs. *Rosenthal*, living exactly opposite the scene of the explosion, spoke to having perceived a strong smell of gas for a month or two prior to the accident. She complained of it to a man who was doing something to the lamp more than a week before the occurrence.

Dr. *F. H. Oliver* gave evidence as to the injuries sustained by the plaintiff; he having examined him in January of the present year. He said he did not think the boy would ever recover the full use of his left arm. Photographs of the plaintiff's arms had been taken by means of the Röntgen rays; and he had formed his opinion partly by inspecting them. There was a difference in the two photographs; and it was apparent that the bones of the wrist of the injured arm were separated. [The photographs were submitted to the Jury.]

Dr. *H. A. Gordon* also gave evidence as to the injuries.

The gentleman who took the radiographs having given evidence,

Dr. *C. B. Lockwood* was called on behalf of the defendants, and expressed the opinion, after examining the boy, that the injuries he had sustained were not of a permanent character.

[The case was at this point interrupted for more than an hour while the question of the costs in the action of *Fox v. Jerome*, reported last week, was discussed. On resuming,]

Dr. *Hastings* gave evidence as to the state of plaintiff's head and arm and his general health. He said he had examined him twice—once in conjunction with Dr. Lockwood, with whose evidence he concurred.

Tuesday, May 11.

The proceedings were continued this morning, when a number of the Company's servants were called to prove that no smell of gas had been perceptible at the spot in question, and that no complaints of such smell had been made. The fracture in the main, when discovered, appeared to be quite fresh.

Edward Norman, whose duty it was to examine a water-meter close to the lamp-post where the explosion took place, on behalf of the Great Eastern Railway Company, said he did not detect any smell of gas when he inspected the meter, which he did once a fortnight. He sometimes smelt an odour of gas in such meter-pits; and whenever he did so, he made a note of it, and reported it.

Mr. *Bloom*, a meter inspector in the employ of the East London Water Company, gave similar evidence. He also said he had frequently seen boys making bonfires in the streets in the neighbourhood.

George Telling, the foreman of lamplighters to the Commercial Gas Company, said that on the evening in question he noticed a boy up the lamp-post. He saw a light fall, and immediately afterwards the explosion took place. He reported it at once to the nearest office of The Gaslight and Coke Company. He saw a tin kettle sort of thing, with wood and paper in it, near the bottom of the lamp-post; but it was not alight, and there was no sign of any fire about.

Mrs. *Marks*, a neighbour, deposed that she saw a boy up the lamp-post, and that he fell at the moment of the explosion. She was quite sure the plaintiff was the boy; she saw him picked up and taken away. She was standing about 50 yards off.

Mr. *G. F. L. Foulger*, the Chief Distributing Engineer to defendant Company, said the pieces which were cut out of the main when it was repaired were thrown away. The main was laid in 1883; and it was 1 ft. 10 in. underground at the spot in question. He had had a piece of the main cut out since, and found it of exceptionally good quality. The crack was about 8 feet from the meter-box; and the gas would reach there almost instantly. Practically, it would be impossible to open the ground to examine all the Company's mains from time to time. Rewards were given for reports of leakages. He could not account for the fracture which occurred, unless it was due to slight contraction owing to change of temperature.

In cross-examination, witness said he had known such fractures to occur at a similar depth, from alteration of temperature.

This concluding the evidence for the defendants, the father of the plaintiff was recalled to prove that the coat the lad was wearing at the time, and which was produced in Court, did not agree at all with the description given by the witness Mrs. Marks of the coat worn by the boy she saw on the lamp-post. She, in fact, had said the coat produced was not worn by the boy she saw.

Mr. DANCKWERTS submitted that there was no liability upon his cleints; there having been no negligence proved against them. Even if there were any, there was contributory negligence on the part of the plaintiff or of his companions; and this had caused the accident.

Mr. SALTER having addressed the Jury on behalf of the plaintiff,

His LORDSHIP summed up.

The Jury retired to deliberate at ten minutes to four; and, after being absent for about three-quarters of an hour, they returned a verdict in favour of the defendants—intimating at the same time that they thought the Directors might grant the lad some assistance, in view of the fact that he was undoubtedly injured by an explosion of gas, though for this the Company were not, in their view, legally responsible.

On the following morning, his LORDSHIP gave judgment in accordance with the verdict, and certified for a Special Jury. Counsel for the defendants said the recommendation of the Jury would be made known in the proper quarter.

HIGH COURT OF JUSTICE—OFFICIAL REFEREES COURT.

Plymouth—Friday, May 7.

(*Before Mr.* E. POLLOCK.)

The Alleged Nuisance at the Plymouth Gas-Works.

To-day the Official Referee opened an inquiry at Plymouth respecting the claim by Mr. W. Osmond Ward, who carries on the business of a tanner in premises adjoining the gas-works, to recover damages against the Plymouth and Stonehouse Gas Company for injury done to his business by the alleged escape of smuts and dirt from the works of the Company. The case, as our readers are aware, has occupied the attention of the Courts on previous occasions.

Mr. M'CALL, Q.C., and Mr. GRAHAM appeared for the plaintiff; Mr. CHANNELL, Q.C., and Mr. DUKE represented the Company.

Mr. M'CALL stated that since the Company had erected a new retort-house, and carried on their carbonizing operations by means of West's charging and drawing machinery, such a nuisance has been created that the plaintiff found it utterly impossible to conduct his business. He issued a writ on Feb. 2, 1895, claiming damages for nuisance and an injunction against its continuance. This action came before the Lord Chief Justice, with the result that the Company submitted to an order by consent, which admitted the nuisance. The question of damages was referred to Mr. (now Mr. Justice) Ridley, who held an inquiry at Plymouth in April, 1896. Ultimately the defendants consented to an order for the payment of £3200. The questions which the present proceedings were brought to decide were: (1) Whether a nuisance had existed since the date of the last inquiry; (2) whether the defendants had abated the nuisance wholly or partially; (3) whether the plaintiff had sustained any or what damage since the inquiry in April. The plaintiff had carried on a tannery business on premises adjoining the Gas Company's premises for the past twenty years; and it was alleged that the defendants' operations in the new retort-house created dust, smoke, and grit, which were prejudicial to his business. The side of the tannery opposite the retort-house consisted of two storeys. In the lower one there were beds where the hides were steeped. On the floor above there were lofts where the hides, having been steeped, were dried, rolled, and cleaned, and otherwise treated. The sides immediately adjoining the retort-house were supplied with louvres, which were necessary because it was essential that there should be a thorough draught. It was also essential that hides which were either damp or greasy should be kept perfectly free from dust and grit. The result of the construction of the new retort-house was, however, that the open boards of the louvres became covered with dirt and dust, which was blown by wind into the store. The defendants said that since the order was made, they had done two things which had effectually cured the nuisance. One step which had been taken was to cover the intervening space of the coke-yard; the other was the adoption of the Dulier process in the retort-house. That covering the yard was calculated to prevent the dust being driven into plaintiff's premises, he did not dispute. But the roof that had been put there acted as a most convenient place for the smuts and grit to fall and lie upon; and when smuts and grit were covering the roof, a very slight wind blew them over to the plaintiff's tannery. The Dulier process was intended to cleanse the smoke; and when it was applied in the flue of a chimney, into which the whole of the smoke to be treated could be forced, it was no doubt efficacious. But in an enormous place like a retort-house, it was impossible that it should be wholly effective; and smoke escaped through the windows. The Company sought to lay some of the blame on other works adjacent, and also contended that the plaintiff's own chimney caused some part of the nuisance. If these contentions were to be made use of in the present inquiry, it would be for the defendants to prove to demonstration that the works were being carried on in a way different from that which was pursued in 1896, when the Company admitted their liability for the nuisance.

Plaintiff was then called. In his affidavit, which was taken as his evidence-in-chief, he explained the process carried on in the tannery, and stated that up to a recent date the ready-money value of the goods, tan liquor, &c., at the tannery was £30,000. Up to the year 1894, he was put to no inconvenience whatever in conducting his business, and turned out leather of the highest quality and the best appearance. In the newly-erected retort-house, the Company made considerably more gas and coke than in all the other houses put together. This meant that more water was poured on a larger volume of red-hot coke than at any previous time, and more smoke and dust were consequently generated. The new apparatus constructed by the Company with a view to an abatement of the nuisance was a complete failure. The effect of the erection of the roof over the coke-yard had been to diminish the nuisance in calm weather, but to increase it during the prevalence of winds. It was, in his opinion, impossible for defendants to abate the nuisance if they continued to use the new process, and to make such large quantities of gas in one building near his premises. When the wind was blowing south-east or south-west with any appreciable force, it carried the smoke, grit, and smuts directly towards his premises. It was quite wrong to suppose that a great deal of mischief was caused, either by his own chimney or from neighbouring factories. The evidence of this was that while his own and other works were closed on Sundays, the gas-works were not; and fresh accumulations of dirt were found in the tannery on Monday mornings, especially if the wind had been south, south-east, or south-west.

The OFFICIAL REFEREE: Supposing this roof formed a dust-trap for all the dust and smuts of the neighbourhood, and the wind blew it into the tannery, and assuming that no dust or smuts came from the gas-works, would that give plaintiff a right of action?

Mr. M'CALL: I should say it would.

Plaintiff, in answer to Mr. GRAHAM, gave further particulars about his works and processes. He said that the Dulier process was started at the gas-works in June, and the roof over the coke-yard was constructed in September; but since those dates he had frequently been compelled to stop his works in consequence of the nuisance. The machinery had to cease running because smuts, light grit, and fine black dust would have been rolled into the leather, doing it damage. Whenever a strong wind was blowing, from whatever direction, dust from the roof was distributed in his loft. He had many times seen dust and smut settle on the leather while he was standing by, and had observed that they came freely from the chimneys at the eastern and western ends of the retort-house, and from the funnels. They also came from a dozen openings on the south side of the retort-house. Before the present house was built, it was only usual to brush the hides once. Now it was necessary to perform the operation as many as ten times. He learnt from the defendants' affidavits, which were filed the first week in March, that suggestions were made that what he was burning in his own furnace was the cause of the mischief complained of. Up to that time, he burnt coke and spent tan; rarely burning coal. He had never observed any injurious effects from the use of tan; but after reading the defendants' affidavits he gave it up, and burnt nothing but coke. There was, however, no perceptible difference in the extent of the nuisance.

Saturday, May 8.

On the resumption of the proceedings to-day,

Mr. *Edmund H. Stevenson*, M.Inst.C.E., was called, and examined by Mr. M'CALL. He said he inspected the Plymouth Gas-Works and plaintiff's tannery for the first time on Jan. 22, 1896. The chief effect which he observed that the proximity of the works had upon the tannery was that a large quantity of smoke and dirt came into the latter, and spoiled the leather and other material there. There were also "blacks" in the tan liquor; and on the leather they were very marked. He was satisfied that the nuisance came from the defendant's works. At the time of his visit, the new West charging and drawing machinery was at work. The effect of drawing the retorts was to produce a great smother, and to cause an abundance of smoke and dust, which came out of the windows of the retort-house and floated about. Such a nuisance was necessarily worse when the wind was blowing from a southerly direction. The new retort-house was built so close to plaintiff's premises that it was bound to create a nuisance such as was complained of, which was much less likely to be caused by the old retort-houses. In fact, any smoke and grit issuing from it would not have time to deposit on the ground and surrounding buildings before it entered the plaintiff's premises. There would have been no difficulty in putting the new retort-house farther away from the plaintiff's works, on rising ground, and so avoiding all interference with the tannery. There were 352 retorts in the new building, which was 300 feet long by 70 feet wide. There was a minimum of smoke issuing from the building when light charges were being worked and the coal was entirely carbonized before it was drawn from the retort. They, however, always worked with full charges in winter. He made a careful examination of the tannery on the previous Thursday. The smoke which he then found emanating from the building did not approximate in volume to that which he saw in January, 1896, because all the retorts were not in operation at the present time of the year. He did not think the dust and dirt which he found upon the tannery came from the plaintiff's own chimney. There was no roof on the premises so high as the adjoining roofs on the south side. It was well known that in passing over a high roof smoke beat down upon a lower one. He had never before this heard of the Dulier smoke-purifying process being applied to a retort. On the previous Thursday, he was told that the pipe used to draw off the smoke was 2 ft. 6 in. diameter; but Mr. Newbigging gave the diameter as 3 feet. The pipe ran along the whole length of the retort-house; and in order that it might be effective, it would be necessary for the smoke to be drawn in very rapidly. There were openings along the whole length of the pipe to admit the smoke; but it was not physically possible for the smoke and steam of the retort-house to be drawn into the tube. From his observation, he was convinced that this was not being done. As a matter of fact, while they were charging, smoke and steam went through the windows. If the process were effective, one would expect to find a large deposit of dust in the collecting chamber of the apparatus. This was an iron box 5 feet long, 18 inches wide, and 2 feet deep. He examined the box, which he was informed had not been cleaned out since the apparatus was started about June, 1896; and he found there such a quantity of dirt as he would expect to find deposited in a month. From the state of the gasholders and the number of retorts in action, he concluded they were working light charges. On the previous evening, he went down to the gas-works, and stood on the rising ground about 550 yards from the retort-house during the charging of the retorts. Considerable volumes of smoke came from the chimneys, and also out of the retort-house; and it was very offensive to smell and taste even at that distance. The smoke from the retort-house chimney could be traced for a distance of quite 1000 feet. The chimney was smoking for about 25 minutes during his visit; and he left it still smoking. There was more smoke than during a visit in the daytime. This was probably due to carelessness on the part of the men, though practically there must, under the process in use at the works, be smoke whenever the furnaces were charged.

Cross-examined by Mr. CHANNELL, witness said he did not visit the works between January, 1896, and the previous Thursday. Some alterations had been made during the interval. The coke-yard had been roofed, and a change made in the manner of quenching the coke. He did not find the same quantity of dust now as in 1896. The method at present adopted for extinguishing the coke in the retort-house was a proper one. He had always thought that West's stoking-machines caused more smoke than the old process of charging by hand. The time occupied in drawing the retorts was shorter; but it did not take less time to charge them. It was possible for a retort to be drawn and charged by machinery and closed in 1¼ minutes; but he should say that it was not usual in general practice. He should say that, with smart men, a retort could be drawn and charged by hand in 2 minutes. Mechanical stoking and inclined retorts had been largely adopted in gas-works because they were labour-savers, not because these appliances prevented the occurrence of such nuisances as were complained of in this case. There was a difference between the quantity of smoke and dirt produced when the coke was quenched and when it was put into the furnace. It was possible that, while they were on the works on the previous day, 96 retorts were drawn, the coke from 32 of which was put into furnaces, and the rest into the yard. Since January, 1896, the coke-yard had been roofed, and a wall put up; and the louvres on the side of the retort-house next to the plaintiff's premises had been closed. These alterations would probably prevent some of the smoke escaping; but they were not effectual in removing the whole of the nuisance. There was very little in-draught to the tube of the Dulier purifier. There was only an 8-inch jet in the tube; but if the jet were enlarged, and the draught increased, the tube would still not be big enough to carry off the quantity of smoke and dirt generated. He did not think the grit came from the chimneys. Grit would not be carried to the top of the chimneys of the works; but soot would fall, and this would damage the plaintiff's leather. It was impossible for smoke from the chimneys to impinge upon a white surface without discolouring it. The smoke of burnt tar was prolific in the production of soot. He suggested that the grit found its way through the windows of the retort-house, or was blown through the crevices between the slates of the house on to the plaintiff's works. He took samples of the dirt deposited under the slates of a roof on the premises; but he could not say how long a period had elapsed since the deposit was made, nor whether it might not have accumulated before the new retort-house was built. There was a difference in the colour of the dust found upon the leather butts and that which was gathered off the polishing-tables in the plaintiff's works. The dust off the butts was brown, and was probably the dust of the leather or the tanning process. That from the tables was blacker. He could not give a reason for this difference. He suggested that the grit was partly consumed smoke.

Mr. CHANNELL: Is there anything in its character inconsistent with the suggestion that it came from the plaintiff's own works?

Witness: I do not know. I do not see, if that is your theory——

I am not asking as to my theory, but as to your opinion upon the facts. Did you detect any difference in the character of the material itself?—No; it does not matter whether the coke is partly consumed on one premises or another, it will be the same. Witness added that he found a reduction in the dust on his recent visit compared with January, 1896.

Re-examined by Mr. M'CALL: He did not think the grit came from the Corporation stone-breaker or other works in the immediate neighbourhood. The production of coke in the retort-house was about 1200 tons a week. If the plaintiff's consumption of coke was only 3 tons weekly, the quantity of dust and grit on the tannery could not, in his opinion, have come from that source. It would take a longer time to charge and draw by hand retorts producing such a large quantity of gas, than it took by the West machines. If the same quantity of smoke was produced, it would be distributed over a longer time, and a larger area, because the hand-charged retorts would be smaller, and for a similar make would occupy more space. At the time of his visit in January, 1896, the make of gas was 2,800,000 cubic feet; on the corresponding date of the present year, it was 3,665,000 cubic feet; and on the previous day (Friday), it was 1,838,000 cubic feet. On April 23, it was 1,988,000 cubic feet; and on Feb. 9, it was 3,213,000 cubic feet. The latter were the specific dates of which plaintiff complained. Except as regarded quantity, the nuisance was exactly the same as in January, 1896.

Mr. *C. Lane*, a marine engineer, examined by Mr. M'CALL, said he had directed his attention particularly to the question of draughts. He had examined the Dulier apparatus at the gas-works, and tested it by the anemometer. This instrument would be moved by any current going at more than 3 feet per second. The upper portion of the retort-house was filled with smoke at the time; and the apparatus drew it in very slowly—so slowly, indeed, that it could not have all been drawn in. At the hole in the tube, the draught was 10 feet per second; but 18 inches away, there was no draught at all.

Cross-examined: He tested at one inlet, and took two observations of one minute each. The draught was so slight that a large proportion of the "blacks" would settle in the retort-house.

Mr. *H. R. Procter*, F.I.C., Professor of Leather Industries at the Yorkshire College, Leeds, examined by Mr. GRAHAM, said he was an analytical chemist, and had given special attention to the subject of tanning leather. In 1896, he received samples of tan liquor from the plaintiff's pits, and nine packets of dust collected off the pits and the leather in the tannery. One of the samples of liquor was darker in colour than ordinary tan liquor, and contained sediment in which he found iron. Iron made the liquor darker in colour; and smuts and coal dust would discolour the leather, and render it less saleable and less valuable than if it was bright and clean in colour. An analysis of the dust showed that it contained 56·1 per cent. of coke, coal, and graphite; 8·8 per cent. of organic fibre; 18·7 per cent. of transparent siliceous particles; 15 per cent. of white or yellow opaque particles, mainly cinders; and 1·4 per cent. of vegetable charcoal. The coal and charcoal particles would be injurious to the leather. It was a common thing to burn spent tan in tanneries; and it was not injurious. There was no evidence of it in his analysis. A later sample gave 70·2 per cent. of coke, coal, and graphite; and 2·2 per cent. of vegetable charcoal, with lower percentages of the other ingredients. There was a larger proportion of iron in the recent sample than in the earlier one. Samples of dust taken from the roof and gutters of the tannery and from the retorts presented similar features. The liquor in the tan-pits was discoloured by the presence of iron, which he found in quantities sufficient to cause injury. The presence of one or two parts of iron per million was injurious; but it was practically unavoidable. If there was as much as four parts per million, it was distinctly injurious. In samples taken from the plaintiff's pits, he had found as much as 220 and 330 parts of iron per million.

Cross-examined: At the former hearing, he advised plaintiff to gradually renew the liquor, and use it as far as possible for inferior leather. The process of tanning was continuous, until the liquor lost its tanning property, and was run away. In the present case, he understood that the plaintiff had done little tanning recently, and that the liquor had consequently been standing longer than usual. He received a sample of leather of the plaintiff's tanning before the erection of the new retort-house, and found iron in it. The proportion was 0·017 per cent.; and in a sample tanned after the building of the retort-house, it was 0·020 per cent.—very little difference. He did not see any iron fittings about the pits.

Monday, May 10.

On the resumption of the proceedings this morning,

Mr. *Procter* was recalled and re-examined by Mr. M'Call. He said the samples of dust and the amount of pollution of the tanning liquor would vary as the wind was blowing from or to the gas-works. The analyses of which evidence had been given in the affidavits of defendants' witnesses showed the presence of an injurious proportion of iron in the liquor and in the dust collected from the butts and the polishing tables. There was iron in the fittings of the tannery, bands of the troughs, and connections of the pumps; but, as far as his experience went, the presence of this iron did not produce any such injurious effects as were found in this case. It was true that an analysis of some leather tanned before the retort-house was built showed the presence of iron. With this exception, there was no indication of iron before that date.

By the Official Referee: The effect produced by the iron would be greater in proportion to the extent to which it was dissolved. A "sour," or fermented, liquor would produce a darker appearance of the leather than liquor which was not "sour."

By Mr. Channell: He did not think the burning of spent tan produced a smutty smoke which would be a vehicle for conveying the products of the combustion of coke. There would be no difference between the particles of coke from the gas-works and those from plaintiff's chimney.

By arrangement, certain witnesses for the defendants were interposed at this stage.

Charles M'Farlane, a boy 14 years of age, examined by Mr. Channell, said he was employed at the plaintiff's tannery for ten months, and left on the 1st inst. He knew George Adams, who was also in the plaintiff's service. He had seen Adams go on to the roof of the coke-store of the gas-works, and collect the dust. This he dried on the boiler, and then sifted it through a fine sieve. After this he put the dust into boxes, one of which was kept behind a rolling-machine. When the wind was blowing, he would throw this on to the polishing-table and machines, and blow it about. Then he would call Mr. Ward, and they would stop all the machinery and go and do other work. Sheets of blotting-paper covered with starch were laid about from time to time. If there was not much dirt upon these, Adams would put some finely-sifted dust upon them. He had seen this done two or three times. He remembered George Adams going up to London. During his absence, his brother James was rolling wet butts, which was work that George ordinarily did. As he rolled the leather, he would go to the box of dust, throw some of it over the butts, and roll it in. He also put dust on the table. Mr. Ward, jun., was on the works at the time; and James Adams sent witness to fetch him up into the room. Mr. Ward, jun., looked at the leather, and at the dust scattered about, said it was very bad, and directed the works to be stopped. When George Adams returned from London, his brother James told him that the blacks had been very bad during his absence; and George said there would have been a good chance of winning the case if young Mr. Ward had telegraphed to London, as they were in Court at that time. The box in which the dust was kept when sifted was like a dry soap-box wrapped in brown paper.

Cross-examined by Mr. M'Call: His work at the tannery was to oil the butts in the "drying" loft, and to help to pull the butts out of the striking-machine. He had 3s., and afterwards 4s., a week. He asked for a rise about a fortnight before he left, but it was refused; and on the 1st inst. he left without notice. His uncle was employed at the gas-works; and he resided with him now, having formerly lived with George Adams. He left there because Mrs. Adams thrashed him. She did not accuse him of telling lies. He first told his uncle about three weeks ago what he had seen George Adams do. The collecting and scattering of the dust went on for months. He knew of the dispute with the Gas Company. He was on friendly terms with his uncle during this time. He knew that what the Adamses were doing was wrong; and he told his uncle of it about three months ago. What he meant was that he first mentioned it to Mr. Locke since he had gone to live with his uncle. The first communication he made to anyone connected with the case was on Saturday, the 1st inst. A clerk came from the office of Mr. J. D. Bellamy to his uncle's house, and asked him to go to Mr. Bellamy's office. His uncle told him to leave Mr. Ward's. Up to that time—the Saturday afternoon—he had intended to go back to Mr. Ward's. He had no dispute with Mr. Ward, and had no fault to find with him or his work. He did not tell Mr. Ward what Adams was doing, because he did not know who to tell it to; and he thought Mr. Ward would not believe it. He told no one but his uncle and Mr. Locke. He saw Adams collect the dust about a week or two after he went to the tannery. In order to do it, he got up a ladder, leaned over, and took it out of the gutter of the roof of the coke-store. Anyone in the tannery could have seen the ladder and Adams upon it. He (witness) had helped to sift the dust. The coarser part was thrown away, and the fine scattered about as he described. Both the Adamses and a man named Glanville were in the room at the time. He had seen Adams up the ladder on more than one occasion, and had watched him collect the dust two or three times. One box containing dust was always kept behind the rolling-machine, and might have been seen by anyone coming into the room. The machines were stopped fourteen or fifteen times owing to George Adams putting dust on the polishing-table. He frequently threw dust on the leather before it went through the rolling-machines, and it was rolled into the leather. Adams never spoke to him about what he was doing; and witness never asked him any question upon it. He remained on friendly terms with both the Adamses until he left. Mr. Bellamy told his uncle that he was not to go back to Mr. Ward's.

Re-examined by Mr. Channell: Both Mr. Locke and his uncle worked for the Gas Company; and they and he were walking along the road when he first spoke of it to anyone except his uncle. Locke had said something about the Company; and witness said that he could say something, and that if a man named Jones was there he could do so too. It was a fortnight after this that Mr. Bellamy came to make inquiries.

Edwin Jones, labourer, examined by Mr. Duke, said he was in the employ of the plaintiff from 1894 until last November. About breakfast-time one Friday morning in December, 1895, he was leaving the place, but had to turn back for something he had forgotten. Most of the men had left. He saw George Adams come down from the striking-shop and go into the place where the pits are. Adams took out what appeared to be a match-box, and sprinkled some stuff out of it into the pits. The stuff was a smooth black powder. On returning from breakfast, witness looked into the pits, and saw blacks on the tops of the hides and the liquor. He picked up some of the stuff and rubbed it between his fingers. Before he went to breakfast, the tops of the pits were clear. In the course of the day, a gentleman visited the tannery. He came up the yard with the plaintiff and George Adams, and was taken straight to these pits. He had seen butts pulled out of the pits and laid along by the louvres, and had been instructed to place them there himself. While the butts were hanging in this way, George Adams used to come and look at them, and scrape them about; and if he could not find anything there, he would put something.

Mr. Duke: What do you mean by that?

Witness: If he could not find any blacks on the butts, he would put them there.

Where would he get them from?—Out of his pocket.

Did he have the stuff loose in his pocket?—No; he kept it in a little match-box, or something like that.

Examination continued: He only saw this done once; and when Mr. Ward came into the works afterwards, Adams complained, and showed him the butts. The butts were often put into this position while they were wet. He had seen George Adams on the roof of the glue-loft, which was on the same level as the roof of the coke-store. He used to go there nearly every dinner and breakfast time, and scrape stuff off the roof. In the ordinary way, hides remained in the same order in the pits during the whole time they were undergoing the process. When the hides were taken out of the pit, so that the liquor might be changed, the top hide would be placed at the bottom, and the others laid temporarily upon it. By the order of Mr. Bickle, the foreman, they laid aside the top hides out of those of the pits which were near the louvres, and returned them to the pits without putting any tanning material upon them. In the other pits, farther removed from the louvres, the top hides were dealt with in the ordinary way.

Cross-examined by Mr. M'Call: He had had considerable experience in a tannery. He left the plaintiff's service because a large number of pits were stopped, and several hands discharged. He first mentioned to a man named Colmore what Adams had done. This was just before Christmas, 1895. He never told the plaintiff, though he thought Adams was doing wrong. His reason for not complaining was that he considered it would not do him any good, and that his word would not be taken.

Mr. M'Call: If the hide on the top of the pit had been stained, was it not right to keep it from touching the other hides?

Witness: No.

But if it had been stained, and another hide had been put on the top of it, would not the second very likely have been stained from the first?—No, because it was turned upside down; the fleshy part down.

Do you suggest that Mr. Bickle, when he gave you this order, was party to this fraud?—No.

What he told you was a proper thing to do in the ordinary course of business?—No.

What was wrong?—The butts should have been put down on the planks instead of being put on one side.

What do you suggest that putting them on one side meant?—I cannot say.

You do not suggest that there was anything wrong in it?—No; I cannot say that.

Cross-examination continued: When Adams was scattering the dust in the pits, he did not see witness; but if he had turned his head, he would have done so. It was not usual to put the butts out of the tanning liquor near to the louvre boards. They were never put there before the occasion to which he referred. This happened a week after the dust was scattered over the pits. He had often seen Adams on the top of the glue-shed. Between December, 1895, and the previous Monday, he had never mentioned this to anyone except Colmore, who was a workman at the tannery. On the latter day, he was sent for by the Solicitor to the Gas Company.

Charles Henry Colmore, labourer, examined by Mr. Channell, said he was in the plaintiff's service for about two years until January last. He worked in the tanyard. On different occasions, when they went to breakfast or dinner, there were no blacks to be seen; but when they came back, they were scattered about, floating on the liquor in the pits. He did not notice them at the same time on the paths between the pits. There were a few more blacks to be seen on the days when strange gentlemen came to the works to be shown round. On Monday mornings there were more blacks than on other occasions; but he never saw any falling. They used to talk about the visits of gentlemen to the works; and he remembered Jones saying something to him about Adams.

Cross-examined by Mr. M'Call: He was in the plaintiff's employ while the new retort-house was being built, and was there after it was brought into use. He never noticed any smuts coming into the tannery after the new retort-house was started. He saw smuts; but it was not for him to say where they came from. Whenever there was any wind, they were there. At one time he lived at 7, Tannery Cottages; and he complained of the smuts and dirt coming from the gas-works. He did so at Mr. Ward's suggestion, and on his behalf. Mr. Ward did not get him £1 compensation, nor any other sum. He wrote as Mr. Ward asked him to do so. His complaint was of the sulphur fumes, not of smuts. His first interview with anyone connected with the gas-works was on the previous Tuesday, when he was asked to go and see the Manager. He had never previously complained to anyone at the works, and had never said anything to Mr. Ward as to what he had seen. He did not charge anyone with dishonest practices.

Mr. M'Call: Did you think there was someone putting down blacks?

Witness: The blacks were there.

Did you think there was someone dishonestly putting them there?—I cannot say that. The liquor was clean when I went to breakfast, and when I came back the smuts were there.

Do you know that sometimes when you went to meals the retorts were being drawn?—I do not know.

Re-examined: A good many people complained of sulphur fumes. After the complaints, the apparatus (the Claus sulphur recovery plant) from which the fumes came was moved; and then they did not experience the same annoyance.

John Dimmick, labourer, examined by Mr. Duke, said he worked for the plaintiff from 1893 to October, 1895, and was employed in the same

place as the witness Jones. The evidence of Jones as to the manner of dealing with the top hides from the pits was correct. He had seen, when he came back from breakfast, dust and black smuts about which were not there when he went. The dust was on the liquor and on the suspenders by which the leather was hung up, not on the paths between the pits. He never saw any dust blowing down.

Cross-examined by Mr. M'CALL: The blacks appeared after the new retort-house was put up. He could not recollect noticing any before that time. He went to see the Gas Manager at Colmore's suggestion on the previous Tuesday. Before that day, he had never told anyone connected with the gas-works what he had now said. During the whole time he was at the tannery, he never saw any smuts or dust falling on the pits or anything else; nor had he ever seen any coming out of the gas-works. When they were working, the liquor was generally in motion; whereas while they were at meals, it would be still.

Mr. CHANNELL said this concluded the evidence he wished to call at the present stage.

Mr. M'CALL said he should at once produce the persons referred to by the defendants' witnesses, though he had not had any notice of the evidence which had been given, and this mystery had been sprung upon them.

George Adams, examined by Mr. M'CALL, said he had been in Court during the time the four last witnesses gave their evidence. There was no truth in the charge that he put the stuff into the pits or on the tables or the hides for the purpose of helping the plaintiff's case. He had learnt on the previous Friday that M'Farlane was coming to give such evidence; but before that he had never heard anything of the kind suggested. He made an affidavit dated Dec. 5, 1896, and another on Feb. 11, 1897. For the purpose of this case, he had been frequently on the roof of the tannery. He had been in the plaintiff's employ for about eighteen years. Witness then went on to deny categorically the statements made in regard to his proceedings. He remembered the visit of Mr. Fletcher, the Chief Inspector under the Alkali Acts, in December, 1895—the date which Jones fixed. It was not true that hides were hung near the louvres in order to collect dust. When Mr. Fletcher came, a hide was hung in that place in order that it might be nearer the light for his inspection. It was untrue that he (witness) had sprinkled dust over the hides. He used to go to the glue-shed to see the smoke from the gas-works. It was possible that more blacks could be seen on the pits after a meal hour or on a Monday morning, when the liquor had been still, than at other times. The gas-works were going on Sundays, while the tannery and the adjacent works were stopped. There was no truth in the suggestion that he had at any time dealt dishonestly with the dust, for the purpose of making up a false case against the Company.

Cross-examined by Mr. CHANNELL: The two boxes produced, containing dust, were sealed by Messrs. Davis and Tate, two of the experts employed by the defendants. The dust was put there to keep it clean and dry. The boxes were in the rolling-loft. It was not true that the boxes were found in the loft by Messrs. Davis and Tate. He told Mr. Stanley Ward, the plaintiff's son, in their presence, that the boxes were in the loft; and then Mr. Stanley Ward fetched them, and showed them to Messrs. Davis and Tate. The boxes were kept near the engine.

Mr. CHANNELL: Did you show the boxes to Messrs. Davis and Tate before they were found—did you volunteer to produce them?

Witness: No.

Were there not three boxes?—No.

Are you sure of that?—Well, I could not say.

Cross-examination continued: All the dust in the boxes had been sifted by himself for the purpose of being kept as samples. He could not explain why he eliminated some portions of the dust.

Tuesday, May 11.

George Adams was to-day recalled, and further cross-examined by Mr. CHANNELL. He said some of the expert witnesses in the case visited the works on the previous Thursday afternoon. He could not now remember whether or not he was at the works during any part of the dinner hour on that day.

Mr. CHANNELL: What should take you back during the dinner hour on that day?

Witness: We had some work to get up.

But you said you were not there. What time did you stay there?—From twelve to half-past. No; it was from half-past twelve to one o'clock. We came back earlier, my brother James, Glanville, and myself. We were finishing some dry butts in order that I might come here.

Were you paid overtime for that?—Yes.

Is there any entry of that in the time-sheet?—I do not know. I cannot remember working overtime to finish work on any other occasion.

Re-examined by Mr. M'CALL: He received 7d. for overtime for extra work last week; that was 1½ hours, at 4½d. an hour. Painters took from the gutters of the glue-house a quantity of dirt and mould, and put it into buckets. By the plaintiff's orders, he took the stuff and put it on the top of the boilers to dry. He then sifted it to get away the larger pieces. He had thought it over during the night, and now remembered that there were three boxes when Messrs. Davis and Tate visited the tannery. The contents of the third box were put into the other two boxes to fill them up. This was done by Glanville and himself, in Mr. Ward's office, on the 11th of December.

The OFFICIAL REFEREE: One of these boxes is nearly empty. They were both supposed to be full, and then a third box was used for the remainder.

Witness: The third box was a very small one.

Re-examination resumed: They took the three boxes into Mr. Ward's office from the loft near the rolling-machine. The plaintiff and his son, and Mr. Davis, Mr. Tate, and a representative of the Gas Company, were in the office at the time.

The OFFICIAL REFEREE: This seems to me quite a different story from that told yesterday. The story he told yesterday was that when Messrs. Davis and Tate came he was up a ladder, and was asked to get the boxes; and he told Mr. Stanley Ward to fetch them. Now it appears that he and Glanville took them into Mr. Ward's office.

Re-examination resumed: When they took in the boxes, they were nailed down and sealed. Before that they emptied the contents of the third box into the other two.

The OFFICIAL REFEREE: Where is the third box?

Witness: I do not know.

In answer to Mr. M'CALL, witness said the contents of the third box were emptied into the other two in the presence of the gentlemen he had named.

James Adams, examined by Mr. M'CALL, said he remembered his brother George, the previous witness, going to London in March last. During his brother's absence, he was working with the boy M'Farlane. It was not true that he threw dust on the leather, and then rolled it in. Nothing of the kind took place; and he never saw anything of that sort done. It was true that, on his brother's return, he asked about the blacks, and that witness replied that they had been very bad. Nothing was said about telegraphing to London or winning the day. He did not, during his brother's absence, send for Mr. Stanley Ward on account of the blacks. That gentleman was in the loft at the time, and saw the blacks fall; and he ordered him (witness) to stop the machine. He worked half an hour extra on the previous Thursday with his brother and Glanville; and he was paid for it.

Cross-examined: It was true that the rolling-machine could be thrown out of gear, and that there was a brush by which dust could be brushed off the leather as it was being rolled. In spite of this, he did roll the dirt in the leather on the day referred to by M'Farlane. He received 18s. 2d. wages on the previous Saturday, and could not tell why only 18s. was entered in the book. He did not have to ask the clerk for the extra 2d. for the half-hour's overtime. The order to work overtime on that day came to him through his brother or Glanville. He never saw the boxes with the dust in them in the tannery. He was sometimes employed in the rolling-loft, and was there before Christmas; but he did not see the boxes there. He could not say whether it was possible for a box to be near the machine without his seeing it. Sometimes he helped to clean up the room. He would not say the box was not there, but simply that if it was there he did not see it.

Thirza Adams, mother of the last witnesses, said M'Farlane lived with her for nearly seven years. He was a "notorious little liar," and she had to beat him for lying.

Henry Samuel Roberts, a clerk in the plaintiff's employ, examined by Mr. M'CALL, explained that the wages were entered on a sheet last week, and the three men were paid overtime. This was done because the time-book was in Court. He was in the office on a day in December when several gentlemen came, and boxes containing dust were brought in. There were two boxes. He did not remember a third one, or the emptying of the contents of a third box into the others.

Cross-examined: After the boxes were sealed, they remained in the office. He did not keep the time of the men, and did not know how George Adams was paid for overtime made by visiting the tannery on Sundays. He knew Adams had recently gone to the works on Sundays. That was only while the test-papers had been down. He did not know that Adams had any work to do there, nor that he was paid for it.

John Philip Jago, examined by Mr. GRAHAM, said he was a general dealer, and kept a shop near the house occupied by Mrs. Adams. He knew the boy M'Farlane, who was known in the neighbourhood as "Mac the liar," and was very untruthful.

The hearing of the case was at this stage adjourned until June 28, when it is intended to proceed with it until it is finished.

Illegally Connecting a Gas-Meter in Dublin.

Last Tuesday, Mr. Victor Brough, the Manager of the Savoy Theatre, Dublin, was charged at the Southern Police Court, Dublin, by the Alliance and Dublin Consumers' Gas Company with having on May 5 caused to be laid a pipe communicating with a pipe belonging to the complainants, without their consent. According to the case for the Company, they had found it very difficult to get their accounts paid by Mr. Brough; and eventually it became necessary to cut off the supply. This was done on the 3rd inst., at which time between £15 and £16 was due for gas. On the 5th inst., it was found that the gas had again been deliberately connected, and that Mr. Brough was carrying on business there as usual. Between 3000 and 4000 cubic feet had been consumed since the gas had been cut off. Defendant (who was allowed to make a statement) said that a Mr. Farrell wired to the Company guaranteeing £10; but he believed they wanted the full amount. It was on the strength of the telegram that he re-connected the gas. On the 8th inst., Mr. Farrell guaranteed the full amount; and the Company resumed the supply. The Magistrate (Mr. Swifte) imposed a penalty of 40s., with 10s. costs.

An Old Charge and New Defences.

At the Portsmouth Police Court on the 5th inst., Henry Orley, a licensed victualler, of the "Ship and Castle," Portsea, was summoned by the Portsea Island Gas Company for having (it was alleged) feloniously stolen 13,000 cubic feet of gas, of the value of 30s. 4d., between March 1 and 28. Mr. G. H. King, in stating the case for the prosecution, said defendant had two 10-light meters—one to supply the bar and offices, and another for the cellar and certain gas-stoves. As the consumption of gas was very erratic, the Company became suspicious. It was found that on some days the consumption was as much as 454 cubic feet; while on others it fell as low as 7 feet. An inspector paid a surprise visit to defendant's house, and found that one of the meters was covered over with loose sacks. Between the inlet and outlet pipes, a piece of pipe had been inserted, so that gas passed between the two without being registered. On the condition of things being pointed out to defendant and his housekeeper, the latter said that a travelling tinker had visited the house some time previously, and, unknown to the defendant, had been allowed to put on a "patent gas-regulator," which he promised would greatly decrease the consumption of gas in the house. For this service, the man was paid 5s. After the inspector's discovery, defendant appeared to be very anxious to find the man; but he had been unsuccessful. Another peculiar circumstance was that the piece of pipe used in connecting the inlet and outlet pipes was exactly similar to that supplied to ships from the Dockyard. Defendant had been a Naval steward. Every effort had been made in Portsmouth and Southampton to obtain similar pipe;

but it could not be procured outside the Dockyard. Evidence having been given for the prosecution, defendant's housekeeper repeated the story as to the travelling tinker. After private deliberation, the Magistrates committed defendant for trial; bail being allowed.

Arthur Roden appeared to answer a similar charge at the Guildhall, Walsall, last Wednesday. The evidence showed that, on April 29, a meter-inspector, going to the defendant's house, found that the inlet and outlet pipes had been disconnected from the meter, and a connection made by a piece of rubber tubing, tipped with lead at each end. For the defence, it was declared that on the night before the inspector's visit there was an escape of gas, and to correct it the alteration of the pipes was made; the rubber piping being ordinarily used for the conveyance of water into the yard. A fine of 40s. and costs was imposed.

Another Charge of Embezzlement Against a Gas Company's Collector.

At the Westminster Police Court, on the 8th inst., Frederick William Jones, 47, of Liberia Road, Highbury, was brought up on remand, charged on a warrant with embezzling a sum of £146, the money of his employers, The Gaslight and Coke Company. Mr. C. O. Humphreys prosecuted; and Mr. F. W. Tonkin defended. Prisoner entered the service of the Company in 1876, and after some eight years in the office, he was appointed collector for the Hoxton district. He performed this duty until October of last year, when he absconded. At the time he was in receipt of a salary of £350 a year. For a long while he was Secretary of a provident society established among the outdoor workmen in the service of the Company; and it is alleged that he has appropriated some £600 of the funds to his own use. It was stated that this would form the subject of a further charge. Mr. R. Tucker, one of the senior clerks in the rental department of the Company, said he had occasion to see the prisoner about the middle of October last with reference to his accounts. Within a few days of this visit, the accounts apparently balanced; but on investigating them, witness discovered that the cash return-sheets which prisoner had sent to the Company's office were inaccurate. There were omissions of moneys he had collected from customers. Since that time prisoner had never been to the office. Witness laid the information upon which a warrant was granted for the prisoner's arrest. Numerous witnesses deposed to giving prisoner cheques which were not paid into the bank by him. The amounts on the counterfoils of the receipt-books did not in many instances correspond with those on the receipts. Prisoner was again remanded; and, after further investigation of the charges last Friday, he was committed for trial at the Central Criminal Court.

Electric Light v. Gas at Monte Video.—According to the "Financial News," Senor Jose Serrato, the Municipal Director of Public Works at Monte Video, has presented to the Municipality of the capital a proposition to the effect that the Direction of Imposts and Public Lighting shall take steps for the total substitution for gas of electric light in squares; making provisional installations in case the purchase of the necessary lanterns be found excessive. The proposal has been referred to a Special Committee. The Municipality are now practically proprietors of the National Electric Light Company—the only competitor of the Gas Company in public and private lighting; and Senor Serrato is a Director of the former Company. The entire proposal, therefore, resolves itself, the "Monte Video Times" says, "into a plan to injure the Gas Company, which has lent great public services before the Electric Light Company was instituted, for the benefit of the latter; and for this all gas consumers would be made to pay. This is not only an attack on English capital, but also on the general public."

The Quality and Price of Gas at Lichfield.—Since the meeting of the Lichfield City Council in April, at which there was a discussion as to the quality and price of the gas supplied by the Gas Company, some correspondence in regard to these matters has passed between a Committee composed of members of the Council and the Tradesmen's Association and the Company; and at last Wednesday's meeting of the Council, a report on the subject was read. The Company, it appeared, stated that they had no power to alter the prescribed candle power of the gas they supplied, as it was fixed by Act of Parliament. As to the price, however, it had been their intention to reduce it as soon as they were in a position to do so; and they hoped the reduction would take effect from Midsummer. They denied the suggestion that they had spent more revenue upon their works and mains than they were entitled to do; and they promised to consider the proposal that an allowance of 5 per cent. should be made for prompt payment of accounts. They could not agree to provide meters free, and said it was not usual for this to be done. The Committee reported that they had received the balance-sheets of the Company for the last ten years. These would be carefully gone into; and a report thereon submitted if necessary.

Gas-Works Extensions at Sowerby Bridge.—A Local Government Board inquiry has been held, by Colonel J. O. Hasted, at Sowerby Bridge respecting an application by the District Council for permission to borrow £2200 for the extension of the gas-mains to Luddenden and Midgley, and for other gas-works purposes. Mr. R. W. Evans, the Clerk to the District Council, explained that the £2200 asked for was made up of three sums—viz., £1500 for an extension of gas-mains into the districts of Midgley and Luddenden, £200 with respect to a governor-house erected at Luddenden Foot works, and £500 for money which the Council had overspent upon works which were sanctioned by the Local Government Board in 1893. The population of the district was from 11,000 to 11,500. The borrowing powers of the District Council for gas-works purposes were derived from four sources; and altogether they amounted to £102,000. They had had loans sanctioned on account of gas amounting to £81,477; and they had actually borrowed £78,106. Of this they had repaid £45,126, leaving the amount still owing at £32,980. The maximum price they were allowed to charge for gas was 4s. 2d. per 1000 cubic feet within the district, and 5s. without; and the actual prices charged were: Within the district 2s. 3d., in some out-districts 3s. 1d., and at Luddenden Foot 3s. 6d., with a discount in each instance. Mr. J. Marsland, the Manager of the gas-works, supported Mr. Evans's statement. There was a little opposition to the proposals.

MISCELLANEOUS NEWS.

PRESENTATION TO MR. CHARLES GANDON, M.INST.C.E.

The officers and men employed by the Crystal Palace District Gas Company, to the number of about two hundred, assembled in the recreation room on the works, last Saturday, to take part in a presentation to Mr. Charles Gandon, on his retirement from the post of Engineer to the Company, which he has filled for the past twenty years. The testimonial consisted of a large and handsome writing-table, with revolving top, and a revolving chair; the former bearing the following inscription engraved on a brass plate: "Presented to Charles Gandon, Esq., M.Inst.C.E., on his retirement from the Crystal Palace District Gas Company, by the officers and workmen, to mark their esteem and appreciation of his genial treatment during the twenty years he has been Engineer to the Company. May, 1897." In addition to these gifts, there was an elegant timepiece and a pair of bronze statuettes for presentation to Mrs. Gandon.

Mr. Charles M. Ohren, the Secretary to the Company, made the presentation on behalf of the donors. In doing so, he said their meeting together on that occasion was a source of pleasure mingled with regret. It was a pleasure to them to bear their assurance to Mr. Gandon of the great respect and esteem in which he was held by the whole of the employees of the Company. Their regret arose from the fact that they would miss Mr. Gandon's presence among them, and because they had to bid farewell to one who had been a friend to them all. As a colleague, he had personally to thank Mr. Gandon for many little acts of courtesy and kindness. Mr. Gandon had lived a very active life both in England and abroad, and he was well entitled to the rest which he was seeking by retirement from the constant responsibilities of his present position. Yet, though Mr. Gandon was giving up the engineership of the Company, no doubt his professional experience, gained from many sources, would still be available to those who sought his advice; and probably his time would be fully occupied, because there were few men in the profession who could discuss the technicalities of the gas industry in three or four different languages. He had now to ask Mr. Gandon's acceptance of the writing-table and chair before him, and, on behalf of Mrs. Gandon, of the clock and bronzes, as a tangible expression of the donors' appreciation of Mr. Gandon's genial and kindly treatment of officers and workmen during the twenty years he had been Engineer of the Company. This was not the first time they had borne similar testimony to Mr. Gandon's good qualities. He hoped Mr. Gandon might have long life and health with which to enjoy his well-earned retirement, and see his family grow up in happiness and prosperity. In expressing this wish, he could assure Mr. Gandon he was echoing the sentiments of his many friends.

Mr. Gandon, who was loudly cheered on rising to respond, said it was with very mixed feelings that he stood before them on that occasion. He had been connected with them most intimately for the past twenty years, and this connection had been such a very pleasant one that it was with great regret that he was about to sever it. For some reasons he was pleased to have a little more leisure at his disposal; but at the same time his relations with them had been at all times so pleasant that he could very well wish they might longer continue. During the past twenty years, they had seen many changes take place. He still saw many faces which were there when he came to the works. Others who were at that time running about as little children now looked down upon him, as far as stature was concerned. That the time had passed pleasantly to himself was greatly due to the cordial assistance he had met with from all connected with the Company. They had been able to work so amicably together, that things were bound to go on pleasantly and prosperously. He was not going to live very far away from Sydenham, and he trusted they would still see a little of each other in the future. When he did come among them, he hoped he should see the same smiling faces he saw around him that day, which bore evidence of prosperity and contentment. For their handsome presents, he hardly knew how to thank them. He could assure them that such gifts were quite unnecessary to ensure the kindly remembrances he would carry away with him. Under any circumstances, they would not be wanting. At the same time, the gifts would remind him daily of the kind friends from whom they came; and he would always regard them with very great satisfaction, though he would have been quite content with the knowledge that he was leaving with their good-will. On behalf of Mrs. Gandon, he also thanked them very warmly for the handsome way in which they had expressed their kind sentiments towards her. She had always taken a great interest in their welfare, and wished them increased prosperity in the future. For himself, he trusted that the Crystal Palace District Gas-Works might go on and prosper for many years to come; and this desire included the success of all those who were connected with them, because they must one and all recognize that their own interests were inseparably bound up with the prosperity of the Company. He again thanked them all very sincerely on behalf of his wife and himself.

A vote of thanks having been passed to Mr. Ohren for his services in making the presentation, the ceremony, which was marked by much genuine heartiness and good feeling, came to a close.

PROFIT-SHARING IN THE GAS-STOVE TRADE.

The Directors of Messrs. Richmond and Co., Limited, of Warrington, Stratford, and London, having decided to introduce profit-sharing in all the branches of their business, the occasion of Mr. and Mrs. E. W. T. Richmond's annual tea and entertainment to the employees of the Company was considered to be a fitting opportunity for celebrating this new departure. On Saturday, upwards of five hundred employees and friends gathered together in the large hall of the gymnasium, which had been suitably prepared for their reception. After the tea, Mr. E. W. T. Richmond, as Chairman and Managing Director of the Company, explained the details of the system which he and his co-Directors had formally

decided to adopt. No system of profit-sharing being in operation in any of the other works in Warrington, very little was known on the subject locally, and profound interest was manifested by the workmen present. At the opening of his speech, Mr. Richmond referred to the general improvement of the working classes during the last sixty years; and he then went on to speak of the various ways in which employers endeavoured to promote good feeling among their employees, such as occasional feasts and excursions, but which he felt only tended to promote a passing feeling of interest; and he was convinced that no better method could possibly be conceived of causing them to work harmoniously together, than that of voluntarily giving them a share in the profits. This method he was sure would inspire them with a fixed determination to look after the interests of the Company, to turn out the work in the best possible style, and to prevent all forms of waste. The pronounced and emphatic success of the profit-sharing system introduced into the business of the South Metropolitan Gas Company by that noble pioneer of the principle Mr. George Livesey, was a guarantee that profit-sharing could be worked beneficially to both employers and employed. He then told those present that they were to share in the profits of the Company on the basis set forth in their printed programmes, and they would share in the losses—if there were any—by having no profits to receive in recompense for their increased efforts. The idea was no new one to him, as it had occupied his mind for a long time past; but it had cost him five years of continuous effort to bring it to completion. It was a most important scheme, as those employers who wished to create the best feeling between themselves and their servants would watch their progress with careful and scrutinizing vision; and he hoped they would all determine to make it a great success, both for the benefit of their own Company and for the general welfare of the working classes. After a vote of thanks to Mr. Richmond had been proposed and enthusiastically passed, the remainder of the evening was occupied with a most enjoyable concert.

PROPOSED EXTENSION OF THE DUNDEE CORPORATION GAS-WORKS.

Report by Mr. W. M'Crae.

The Gas Engineer to the Dundee Corporation (Mr. W. M'Crae) has issued his report on the projected extensions of the gas-works, with special reference to the proposal made some time ago to purchase a piece of ground in the vicinity of the works. He gives in a table the increase of the consumption of gas during the last ten years. In 1888 it was 385,096,900 cubic feet; while it is now 547,500,000 cubic feet. During this period, there has been a total increase of 162,403,000 cubic feet, or an annual increase of 16,240,300 cubic feet. Should the trade of the city continue in an average state of prosperity, the gas consumption a few years hence should be upwards of 700 million cubic feet. Though the demand for electric light has increased, so has that for gas, which Mr. M'Crae thinks is due to the fact that householders are desirous of better lighting in their homes, and there is also an extended use of gas for heating, cooking, and motive power.

With regard to the extensions which will be necessary within the next few years, Mr. M'Crae states that at present there are two retort-houses, containing 300 and 228 retorts respectively; but, as a number of these are of such a kind as to be expensive to work, he thinks they should be replaced by others on the most approved principle, and from which the best results could be obtained. After this reconstruction, the number of retorts will remain as at present; but by the alteration, together with the adoption of carburetted water-gas plant of a minimum capacity of 2 million cubic feet daily, no further extension will be required for probably ten years. But should retorts be adopted instead of the water-gas plant, a new retort-house will have to be erected of such a size as will accommodate retorts capable of producing 4½ million cubic feet daily; thereby obviating the necessity for the alterations in the west section retort-house, and allowing ample space for the extension of the purifying plant and other purposes. Mr. M'Crae, however, strongly recommends the adoption of the water-gas plant. There is sufficient space to extend the condensers as occasion may require. The scrubbers are much too small for present requirements; but they can be extended without more ground being required. Should the consumption of gas continue to increase at the present average rate, there is only room to extend the purifiers to meet the needs of the next few years. The station meters are much too small for present wants; but when they are extended, ground can be had (with a little excavation) behind the engine-room sufficient to accommodate them.

The extension of the gasholders should no longer be delayed. At present the total holder capacity amounts to 2½ million cubic feet; but the daily consumption in the winter months far exceeds this quantity. The recognized maximum of the most eminent engineers is that the capacity of the gasholders should equal the highest daily consumption of gas. During the past winter in Dundee the amount was exceeded on 71 days; in 1895-6, on 51 days; and in 1894-5, on 44 days. Mr. M'Crae urges the necessity for proceeding with this work without delay. Only a gasholder can be erected on the present lands of the Commissioners; but by doing so coal storage room for about 2000 tons will be taken away, as well as the railway connection between the Railway Company's property and the works. The proposal to do away with the small gasholder at the south-east corner of the works, and to erect a larger one in its place, should not be entertained, as the present value of the holder is about £7400, and requires little repair to make it equal to new. Besides, a new gasholder would take about two years to erect; and during that time the storage capacity would be reduced by 370,000 cubic feet—thereby endangering the lighting of the city still further while the operations were going on. This small gasholder would do for a relief holder in connection with the water-gas plant.

Mr. M'Crae states that the ground now occupied by the works is fully utilized, and additional land is required to accommodate the new ones. The purifiers sanctioned some months ago deprived them of storage room for 1500 tons of coal; and storage accommodation will be still further reduced by the utilizing of such space for the carburetted water-gas plant. When it is considered that during November, December, and January the quantity of coal used is upwards of 22,000 tons, it will be seen that it is necessary to guard the lighting of the city against any trade or other trouble. During the recent railway strike, the stocks were reduced to about ten days' supply, with the exception of what was brought from England, the gas from which is unsuitable for the requirements of the city. The ground to the east of the works (with the exception of about 70 poles unsuitable for the extensions unless at a large expense for excavations) is particularly well situated for the enlargement of the works, and is, in fact, the only ground that can be utilized for the purpose. Though only about half this ground will be built upon or used for railway sidings immediately or in the near future, the whole can be acquired, and whatever is not now needed can be let to yearly tenants for stores as at present. Should the coal-stores be extended to this ground and the railway connected to them, as well as to the existing works, a considerable yearly saving would be effected in the working expenses, as all the waggon haulage would then be done by a locomotive engine instead of by horse haulage.

BRADFORD CORPORATION GAS SUPPLY.

The Clayton Gas-Works Purchase Question—Dr. Dvorkovitz's Claim.

At the Meeting of the Bradford Town Council last Tuesday, the Gas Committee reported that a Special Sub-Committee had further considered the report of the Gas Engineer as to the proposed purchase of the Clayton Gas Company's undertaking; and they had resolved that the Company be informed that the price they ask (£111,800, including a mortgage debt of the market value of, say, £17,500) is equivalent to £1760 per million cubic feet of gas made in 1896; whereas the Bradford works were purchased by the Corporation for £220,000, equal to £430 per million feet in 1871, and the capital expended on the Bradford works to the end of 1896 was equal to £368 per million feet made. The Committee also reported that they had received the following letter from Dr. Dvorkovitz: "It is now more than three years since I signed an agreement with your Corporation, undertaking, in conjunction with Mr. Isaac Smith and Mr. W. W. Shaw, to erect an apparatus for the purpose of gasifying oil, diluting it by water gas to the extent of 40 candles, and guaranteeing thereby that the cost of the gas shall not exceed a certain price. At the beginning of 1895, I informed your Corporation that I had completed my experiments; and the Gas Committee instructed their Engineer (Mr. Wood) to make a test of one month's continuous working of the said apparatus, and to report the results of such test to them. This has been done accordingly; and the results of the thirty-three days' test have been reported to the Gas Committee by Mr. Wood, the responsible Engineer of your Corporation. These results were highly satisfactory; and I have naturally expected that the Corporation will fulfil its obligations in paying us the sum mentioned in the agreement, with the expenses incurred. But the Gas Committee, the 'Conservative members' of which have been hostile to my process from the beginning, in spite of the favourable report of the Corporation Engineer, decided not to adopt it. Such decision has been, however, considered very unfair by the Council, and by a majority was returned for reconsideration. Since then more than eighteen months have passed; and I am still unpaid for the apparatus and expenses incurred. The cost of the apparatus has been considerably higher than what I anticipated, which is chiefly due to the hostile opposition of your Committee; and I do claim that the expenses incurred amount to £1500. If I do not receive in the course of seven days a satisfactory reply from the Corporation, I shall have to apply to the Court. I must also notify you that on the 9th of March, 1897, an agreement between Mr. Isaac Smith, Mr. W. W. Shaw, and myself has been entered in the register of the London Chamber of Arbitration, which contains the following clause: 'The control of the Bradford plant to be entrusted to the Doctor upon the terms of his paying two-thirds of any sum he may obtain for it to Messrs. Smith and Shaw, who are to divide such two-thirds in proportion to their respective contributions to the expense of the plant.'" The Committee stated that they had resolved—"That after full trial of the apparatus and process patented by Dr. Dvorkovitz for the making of gas from oil, this Committee does not deem such apparatus and process to be a success, and that the Council be accordingly recommended to endorse this opinion, and request the owners of such plant as does not belong to the Corporation to remove the same from the Corporation works."

The Mayor (Mr. T. Speight), the Chairman of the Gas Committee, moved the adoption of the minutes; and Mr. W. E. Aykroyd seconded the motion.

Mr. J. S. Toothill asked for some statement respecting the resolution come to by the Committee in regard to the oil-gas question.

The Mayor referred to the past history of the subject and to the reluctance shown by the Committee for some time back to reopen the question. He had himself previously mentioned the matter; but it was said that the Committee had had enough of oil gas. He had since been told that this reply was made in a jocular sort of way. If it was, he could not help it; but he was serious enough in wishing the matter to be brought forward. The question had again been mentioned in his absence; and he understood that practically a similar reply was given. Since then Mr. Isaac Smith and Mr. Shaw had withdrawn from the plant, or had not had any connection with it.

Mr. R. Pratt suggested that it would be unwise to pursue the subject at present, as there might be further proceedings.

The Mayor said he did not wish anyone to suppose that he shirked anything, or kept anything in the dark. He would confine himself, however, to saying that the Committee came to the decision that it was not worth while at present to undertake "this affair;" and by resolution they had asked Dr. Dvorkovitz to remove the portion of the plant which belonged to him.

The minutes were confirmed.

Burslem Gas-Works Profits.—It was reported at the meeting of the Burslem Town Council last week that the result of last year's working of the Gas Department was a profit of £1087; and it was agreed that £1000 should be applied in reduction of the general district rate.

THE NEW RETORT-HOUSE RULES AT THE LEEDS GAS-WORKS.

A meeting of two shifts of the men employed at the New Wortley gas-works of the Leeds Corporation was held last Tuesday, for the purpose of hearing the report of a deputation which met the Gas Committee on the previous Friday, relative to the new rules for mechanical stoking at the works (*ante*, p. 1080). Mr. Wood, the District Organizer of the Gas Workers' Union, gave a detailed account of what took place at the conference. He called attention to the statement made by Mr. Lowden, Chairman of the Gas Committee, with regard to the time taken by the men in making each "draw." The maximum time, the Chairman said, was 40 minutes, and the minimum 26 minutes per draw. The average was 34½ minutes.

Several of the men pointed out that this was not exactly a fair way of looking at the matter. At present, No. 3 retort-house was not in full operation. When the whole of the retort-house was being worked, the time occupied in making each draw would be from 45 to 50 minutes. It was the opinion of the majority of the men that the additional assistance to be given to them when the ascension-pipes became blocked would help them slightly. It had been the custom formerly to afford help when the pipes were blocked above a certain distance. The men, it is said, hope at an early date to institute a system of chipping the mouthpieces, which will make their work lighter than it is at present. The following resolution was eventually passed: "That this meeting of New Wortley gas workers in No. 3 retort-house contend that, since the resumption of work, they have not worked strictly according to the new rules. If the Committee are satisfied with the amount of work which is now being done, we hope they will render such additional assistance as the work demands in the summer-time, such as sweeping up scattered coke, chipping retorts, and slacking at the coke heap."

WIGAN CORPORATION GAS SUPPLY.

Annual Statement.

At the recent Monthly Meeting of the Wigan County Borough Council, the Chairman of the Gas Committee (Mr. Alderman Holmes) made a statement respecting the working of the department during the past financial year.

Alderman Holmes, in the first place, stated that the profits had come below those of the previous year by £47, although, had the price of gas been maintained throughout the year at 3s. 2d., it would have added about £1030 to their funds, and would have increased the balance to that extent. There were other things that had conduced to lessen the income of the year. One large consumer for the purpose of heating, and using about 4 million cubic feet of gas per annum, had begun to provide and make his own gas; and the Sub-Lighting Committee had reduced the consumption of gas for the public lamps to about a million feet. These things together conduced to bring down the average from what it was, although they were so little below it that they might practically say it was the same as the preceding year. The Committee had transferred £10,700 to the district fund account. The expenditure on revenue account likewise had been heavier this year than in the previous one, or would be next year. He had gone through the returns issued by the Board of Trade relating to authorized gas undertakings; and he found that, in the whole of England and Wales, there were about 157 local authorities who were supplying gas. Of these he had selected twenty towns within a radius of forty miles—including Birkenhead, Manchester, Oldham, Rochdale, Bury, Bolton, Burnley, Blackburn, and other large towns—and had taken out the amount of gas they had made during the year. In Manchester it had reached 3,764,345,000 cubic feet; and taking the average yield of the whole of the towns, which varied from just under 9000 cubic feet to about 10,500 feet per ton of coal and cannel carbonized, with one exception he found that the average production per ton was only 9502 cubic feet. Last year their own make was 318,954,000 cubic feet, or a yield of 11,622 feet to the ton. It would therefore be seen that Wigan was making 2120 cubic feet more per ton of coal and cannel carbonized than the average of the twenty towns he had named. The 2120 feet, multiplied by 27,808 tons, would amount to 58,952,000 feet; and if they took this at the average net price of 2s. 7½d. per 1000 cubic feet, they found that it represented £7237. This, at all events, showed that the gas undertaking was on right lines, and that the management of it was in able hands. The number of consumers had increased during the year by 378 for illuminating purposes and 38 for cooking. There were only four other towns in Great Britain which succeeded in making above 11,000 cubic feet per ton. These were Barrow-in-Furness, 11,165; Oldbury, 11,267; Stourbridge, 11,492; and Dumfries, 11,493. Of the 151 authorities in England and Wales who supplied gas, 38 furnished meters free, and in 119 cases they had to be paid for. In Scotland there were 33 authorities, of which 18 supplied meters free, and 15 charged for them. In Ireland with only seven gas-supply authorities, five supplied meters free, and two charged. He moved the adoption of the minutes.

Alderman Gee, who seconded the motion, thought that not only the Corporation but the whole town ought to be gratified at the result of the working of the gas undertaking during the year. The bulk of the credit belonged to the Gas Engineer.

Alderman Farington congratulated the Committee and the Council on the good report; and he pointed out that some time ago the man who had produced these good results for the town asked for an increase of salary, and the town, through the Corporation, refused it.

Mr. M'Quaid did not think it was fair to the members to discuss the report only 24 hours after it was placed in their hands. He thought the number of consumers had been increased between 300 and 400 in the past year; and the price of cannel was less than in the previous year. Still they had made less profit; and he had no doubt that, when they compared the reports, they would find out why it was so.

The Mayor (Alderman Richards): There has been a reduction in the price of gas.

Alderman Gee: There has also been a very great reduction in the price of coke.

Mr. M'Quaid said he dissociated himself from the policy of handing over to the relief of the rates more money than the undertaking had earned. The gas-works had only earned about £9000; and the Committee were handing over £10,700.

Alderman Holmes said if Mr. M'Quaid would take the trouble to look at the accounts, he would find that, while the net profit of the undertaking for the year was £9696, the sum of £1035 was brought forward from the previous year. It was an unspent balance; and therefore with the profits of last year, the balance in hand at the present time was £10,734 4s. 6d.

The motion was passed.

COVENTRY CORPORATION GAS SUPPLY.

Duplication of the Water-Gas Plant:—Proposed Auxiliary Works.

At the Meeting of the Coventry City Council last Tuesday, the Gas Committee submitted their report recommending the duplication of the water-gas plant, as noticed in a paragraph last week.

Alderman Andrews, in moving the adoption of the report, said the annual average increase in the consumption of gas in most English towns was about 3 per cent. For instance, a ten years' average of the increase in the supply of The Gaslight and Coke Company was 3 per cent. In Coventry it had varied. Generally there had been an increase; but on two occasions since the Corporation had been in possession of the undertaking, there had been actually a decrease. Owing to the enormous expansion of the cycle trade, the increase in the consumption in the year ending March 31 last was 24½ per cent.; so that they had actually had eight years' increase in consumption in one. Last summer or autumn, the Gas Committee approached the Council to sanction the erection of a water-gas plant at a cost of £7000. The largest consumption of gas in Coventry in one day last winter was 2,600,000 cubic feet. The water-gas plant was started in February, had been in full work for two or three months, and would increase the means of production to the extent of 600,000 cubic feet—that was, by about 25 per cent. He might mention that the 2,600,000 cubic feet of gas supplied on one day last winter was about the utmost capacity of their then works. The water-gas plant had since increased the capacity by about 25 per cent.; but that was already booked. He ascertained that, in February last, there were being erected in Coventry at least 20 new gas-engines, and preparations were being made for between 6000 and 7000 additional gas-burners; so they might consider that the additional 25 per cent. which the present water-gas plant provided was already booked. Therefore they wanted a large supply to carry them through next winter. The erection of water-gas plant in Coventry had turned out a thorough success; and the Committee now came to the Council with a recommendation that they should double the plant at an additional cost of about £3500—making the total expenditure £10,500. The resolution passed by the Council last autumn for the erection of a water-gas plant, authorized the Committee to supply a mixture of 75 per cent. of coal gas, and 25 per cent. of water gas; but recently, for experimental purposes, a much larger proportion of water gas had been distributed. Mixtures had been supplied during the last month with 30, 40, and 50 per cent. of water gas; and one day over 60 per cent. was mixed with the coal gas, and no one had noticed any difference in the quality of the gas except, he thought, that some persons remarked that the illuminating power seemed to have been rather better. The recommendation of the Gas Committee, if carried out, would increase the total means of production of water gas to (roughly speaking) 1,200,000 or 1,250,000 cubic feet per day; and this, with a capacity for 2,600,000 cubic feet of gas per day, would enable them to supply the city with a mixture consisting of about 33 per cent. of water gas and 67 per cent. of coal gas. The means of production would then have been increased over what they were in December last to the extent of 50 per cent., at the small cost of £10,500. The Committee also had under consideration a scheme for auxiliary works. To commence with, they would provide for the production of 1,250,000 cubic feet a day of coal gas—that was, the same quantity that the new water-gas plant would produce; and the cost of these works was not likely to be less than £80,000. But the question would naturally arise: "If that be the case, why is it that the Gas Committee propose to spend eight times the money in erecting plant to produce identically the same quantity of gas?" The reason might be expressed in one sentence—that in the present state of knowledge, the Committee did not see their way clear to increase the water gas permanently in Coventry beyond 40 per cent., or, in case of emergency, for a day or two, beyond 50 per cent. The question had to be looked at all round. In Coventry they wanted an article of a thoroughly reliable all-round character, because gas was used considerably for illuminating purposes, very largely in manufacturing and for brazing, and very extensively for gas-engines (of which there were upwards of 400 in use), and also very largely for cooking. The information as to the auxiliary works was given in order that the Council should have about four months to think over the matter. There was one more reason, possibly, why it might be undesirable to increase the consumption of water gas beyond the extent mentioned. It was that the petroleum required in the manufacture was brought from Russia or America. If war broke out, they might have the supply of petroleum cut off; and then they would be in a complete fix as to the gas supply.

Mr. Drinkwater seconded the motion; and it was adopted after a brief discussion, in the course of which it was mentioned that the expenditure of £3500 would practically exhaust the present borrowing powers of the department.

The South Molton Gas-Works.—The Corporation of South Molton decided last Tuesday to ask the Local Government Board to sanction a further loan of £1000 on gas-works account. It is intended to erect a new exhauster and a coal-shed, to provide a photometer, and carry out other necessary improvements, as well as to repay advances made by the Town Council in connection with the purchase of the works.

STALYBRIDGE CORPORATION GAS DEPARTMENT.

Annual Accounts and Working Statements.

The accounts of the Gas Committee of the Stalybridge Corporation for the year ending March 25 have been published. From them we learn that the total expenditure was £16,018, of which £6905 was for coal, and £4195 for repairs and maintenance of works and plant. On the other side of the account, the figures are: Gas-rental: Private consumers (113,429,900 cubic feet), £15,660; public lamps (7,608,200 cubic feet), £1014; slot meters (extra amount), £29—total £16,704. Residuals: Coke, £1351; tar and ammoniacal liquor, £1266; sulphate of ammonia, £455—total, £3073. Sundry items made a total income of £20,379, and gave a gross profit of £4360. Alderman Holt, the Chairman of the Gas Committee, stated at the last meeting of the Council that it has been decided to reduce the price of gas, and to pay a subsidy to the borough rate of £493. The total saving on the year in expenses was £443. He also mentioned that it will be necessary to spend still more money on the works, in order to enable them to do their best, and the Engineer (Mr. W. Carr) to obtain the best results in illuminating power and pecuniary profit. Mr. Carr's abstract of the working statements of the year showed that the total quantity of gas sent out was 137,115,500 cubic feet; while there was sold to private consumers 112,104,000 feet, consumed in public lighting 7,608,200 feet, and used on the works 1,325,900 feet—making a total consumption of 121,038,100 feet, and leaving unaccounted for 16,077,400 feet. The quantity of coal carbonized was 10,726 tons, and of cannel 2805 tons. The amount of gas made per ton of coal was 10,130 cubic feet, and sold 8942 feet. The illuminating power of the gas averaged 19·55 candles.

SOUTHPORT CORPORATION GAS ACCOUNTS.

At the Meeting of the Southport Town Council last Tuesday, the Borough Accountant (Mr. G. Lloyd) submitted his annual report on the Treasurer's abstract of accounts for the year ending March 31. In regard to the gas department, it was stated that the profit for the year was £8839, against £9899 in the preceding year. The amount anticipated to aid the rates for 1896-7 was £7965, leaving a net profit of £874 to be transferred to the borough fund account. The sum of £200 has been added to the reserve fund, which now stands at £1887. During the past five years, the income has been: 1893, £56,322; 1894, £60,466; 1895, £68,122; 1896, £62,225; 1897, £64,256. Expenditure: 1893, £51,866; 1894, £53,555; 1895, £52,066; 1896, £52,326; 1897, £55,417. Profit: 1893, £4456; 1894, £6911; 1895, £16,056; 1896, £9899; 1897, £8839. The gross income derived from the sale of residuals, including stocks on hand, for the same period is as follows—Coke: 1893, £5349; 1894, £6108; 1895, £7734; 1896, £6810; 1897, £5489. Tar: 1893, £1794; 1894, £1977; 1895, £2224; 1896, £2712; 1897, £3538. Sulphate of ammonia: 1893, £3155; 1894, £3829; 1895, £3980; 1896, £3336; 1897, £2486. According to the minutes which the Gas Committee submitted on the same occasion, an application is to be made to the Local Government Board for power to borrow a sum of £5000 on gas-stove account.

THE DUBLIN CORPORATION AND THE GAS COMPANY.

The Recent Prosecution of the Company.

The subject of the proceedings recently taken by the Dublin Corporation against the Alliance and Dublin Consumers' Gas Company for not affording facilities for the testing of their gas by the Corporation Gas Examiner on the 16th and 19th ult. (both public holidays), as reported in the "JOURNAL" last week, came before the Municipal Council at their meeting on the 10th inst. The matter was introduced by Alderman Meade, who, seeing the Chairman of the Gas Committee (Alderman Mulligan) in his place, asked permission to bring it forward. He said he had heard a great deal from the citizens in regard to the action of the Corporation; and he thought Alderman Mulligan should give the Council some information as to why such a course was adopted. Mr. Thompson here interposed the remark that it was "shameful." Alderman Meade went on to say that, as a member of the Gas Committee he supposed he ought to be joined in the censure, if the Corporation thought it necessary to pass such a vote. But he was not a constant attendant; and as the action appeared to have been taken at the instance of the Gas Inspector, and adopted by the Committee, he considered the Chairman of that body ought to give some reason for their action. Mr. O'Mera, who occupied the chair in the absence of the Lord Mayor, expressed his gratification that the subject had been brought forward by Alderman Meade, because to the great majority of the Council the record of the Police Court proceedings must, he said, have come, not only with great surprise, but with regret that the Corporation should have embarked in such an action, which, whether successful or not, could not have redounded to the credit of the Corporation. It was a very trivial offence. A member remarked that it was no offence at all. Mr. O'Mera went on to say that every member of the Council ought to have been made acquainted with the matter before they as a body embarked in any litigation. They were all responsible to the citizens for the revenue of the Corporation. He considered that some explanation was necessary as to why the proceedings were instituted. Mr. Jones objected to the discussion as being irregular. He said the matter was not on the *agenda;* and he had yet to learn that it was the privilege of any member of the Council to spring a debate upon them. Mr. O'Hara repeated that he thought they ought, in common courtesy, to be made acquainted with the reasons for the action of the Committee; and if the Chairman did not see his way to giving the required information, the matter must close. Alderman Mulligan said the action of Alderman Meade was rather novel. If any information was wanted from the Gas Committee as to their action in this matter of bringing the Gas Company into the Police Court, he was sure the Committee would give sufficient answer to the Council. If any motion was made that the Committee should report to the Council as to why they instituted these proceedings, the Committee were able to take care of themselves, and give the information. He did not see why it should be sprung upon the Committee on the present occasion. The information asked for would be given; and the Committee would justify their action fully before the Council and the citizens. Mr. E. W. Smyth said he was a member of the Committee, and if he had been present he would have voted against the action, for he looked upon it as vexatious and frivolous. He regretted extremely that he was not present to record his vote against it. Mr. J. P. Smyth said he also was a member of the Committee, but, unfortunately, he could not attend. If there was any springing of this matter, it was sprung by the small Committee who met on the day it was decided to take action; there being barely a quorum present. He thought it was most unreasonable to expect the Gas Company's men to remain at the testing-station on Christmas Eve, Christmas Day, and Easter Sunday, especially as the Corporation allowed their own officials to be off duty from Good Friday until Easter Tuesday. Alderman Mulligan remarked that the discussion was anything but courteous to the Gas Committee, who came there to do their duty to the citizens. Mr. J. P. Smyth retorted that very slight courtesy was being shown to the citizens. The matter then dropped.

GAS-WORKS EXTENSIONS AT WORKINGTON.

Local Government Board Inquiry.

Lieut.-Colonel A. C. Smith, one of the Local Government Board Inspectors, has held an inquiry at Workington, concerning an application by the Town Council for authority to borrow £7000 for the purpose of extending the gas-works. The Town Clerk (Mr. J. Warwick) said that the loan was required to provide a new gasholder. The gas-works were purchased in 1847; and there had been expended on capital account £23,658, and out of profits £7483; making a total of £31,141. The amount now owing was £15,384; and the value of the works was something like £50,000 or £60,000. The number of consumers was 2500; and the price of gas was 2s. 6d. per 1000 cubic feet. The public lamps were charged at £2 per lamp, which included lighting, repairs, and maintenance; the total number being 513. The profits for the last three years, after making provision for interest and sinking fund were as follows: 1894, £1237; 1895, £1106; 1896, £1566. The storage accommodation in 1894, when they provided their last holder, was 232,000 cubic feet; and it had continued so up to the present. The gas made in that year was 28 million cubic feet; whereas at the end of March last, it was 61,984,000 cubic feet. There was a corresponding increase in the gas made for private consumption and for the public lamps. As regarded the latter, there were only 213 lamps. In 1894, the mains measured 13 miles, and now 17½ miles. In 1894 the retorts only numbered 48, and at the present time 96. The capacity of the plant was 433,000 cubic feet per day. The proposed new holder would give them storage room for 401,000 cubic feet; and, when completed, they would have provision for 633,424 feet. The quantity of gas made in 1884 was 28,337,000 cubic feet; and in 1897, 61,984,000 feet—an increase of 118 per cent. Mr. J. Johnston, the Gas Manager, submitted the plans and specifications of the proposed extensions. He stated that the life of the new holder was estimated at 50 years. The excavation for the tank would cost £1492; and the brickwork, £850—the total for the tank being only £3094. The holder would cost the rest.

BOMBAY GAS COMPANY, LIMITED.

The Plague and Its Effect.

The Ordinary Meeting of this Company was held on Thursday last, at the London Offices, 6, Drapers' Gardens, Throgmorton Avenue, E.C.—Mr. ROBERT DAVIDSON in the chair,

The SECRETARY (Mr. J. H. Perrins) read the notice calling the meeting; and it was agreed to take as read the annual report and accounts, an epitome of which appeared in the "JOURNAL" for the 4th inst.

The CHAIRMAN said the shareholders would have noticed that the accounts for the past year were not quite so favourable as the Directors were in the habit of presenting. It would be remembered that at the last meeting reference was made to the new contract which had been entered into with the Municipality for public lighting, but on somewhat lower terms than the previous one. At that time, however, private lighting was showing a very large increase; and the Directors were sanguine enough to hope that the increase in that direction would have equalled the reduced profit they were getting on the public lamps. The private lighting went on very well down to and including September. Then the plague came; and it was only natural that a Company like theirs, having its entire interests in the city, should be much affected by it. As a matter of fact, he believed that something like two-thirds of the population ran away into the country. The bulk of the population were Hindoos. They were people who eat nothing but vegetables; and if they got an illness of any kind—a lasting or severe illness—they had little stamina to stand up against it. Naturally they were therefore more easily frightened than Europeans, who were much less affected. Consequently, from October onwards, there had, compared with the previous year, been a considerable decrease in the consumption of gas for private lighting. This had continued up to the end of February (which was the last return received); and the first two months of this year were the worst they had had. At the same time, Bombay was such an important commercial centre, and its harbour was one of the finest in the world, that it was a mere question of the time when the plague disappeared that the prosperity of the city would return, and with that there was every reason to hope the prosperity of the Company would also come. Commenting upon the financial results of the year's working, the Chairman said the shareholders would have noticed that, in order to pay the usual dividend, they would have to take £1061 from the reserve fund. This fund had been accumulated in the past out of profits; and the Directors thought they were quite justified on an occasion of this kind to take that sum from it to pay the same dividend as they had this time last year. The amount remaining in the reserve fund would still

be considerable. Looking at the credit side of the profit and loss account, it would be seen that the rental from public lamps showed a decrease of £4153. This arose almost entirely from the lower terms on which they were paid. On the other hand, in an ordinary year, they would have had a considerable advantage in the saving of coal; inasmuch as the new incandescent burners in the street-lamps only consumed 3½ to 3¾ cubic feet per hour, against 5 cubic feet under the old system. The private consumption had increased by £1038; and the meter-rental by £38. The Welsbach burner was so popular in Bombay, that it was quite obvious the consumption of gas would go on increasing very largely. The residuals were highly satisfactory; the increase under this head having been £2534. On the debtor side of the account, coal had cost an additional £1763, owing to a considerable advance in freights, which averaged some 4s. per ton more. The item of wages increased by £78; purification had decreased by £610; and maintenance of retorts was £394 more. Trade charges had risen by £1747—due principally to the heavy payments they had to make to the Municipality for repairing roads under an arrangement existing last year. For the future the Company would do their own repairs quite as effectively, and, it was hoped, at a material reduction. Salaries were £234 less; and exchange was also lower by £3619—the average rate being 1s. 2⅜d., against 1s. 1 13/32d. The money they had had home this year had been at considerably better rates —1s. 3 7/32d. and 1s. 3 1/32d. There had since then been a fall; but he hoped it would by-and-bye improve again. The Manager (Mr. Louis Penny) reported that the works were in excellent order. They proposed putting up a new holder; and the materials were already in Bombay awaiting erection, which had been delayed owing to the scarcity of labour during the epidemic. On March 19 last, the Manager wrote: "The new system of lighting has been a great success in every way, and is the admiration of everyone who comes to Bombay. It gives no more trouble than the old system; and the light is three times as powerful. The mantles last much longer than was calculated on—nearer three months than two. What to say of the prospects of the current year, I do not know. It has opened very badly. We have had to cut off the supply of 30 or 40 consumers who have run away, owing two or three months' rental. Whether they will return and pay us is a question. Trade and business are ruined for some time to come; and the amount of bad debts to write off next year will be very large indeed." The Directors were, for a time, under great apprehension that the staff might get bitten with the panic, and leave, which would have been a very serious matter for the Company. The Manager, however, wrote: "The devotion of the whole staff, from the highest to the lowest, at a most trying time, is worthy of the highest praise. Not a single clerk has left us, or stayed away; and few firms in the place can say this. The people are now rapidly returning to Bombay, at the rate of 10,000 to 15,000 per week." A telegram from Bombay, dated May 12, also stated that the plague returns were at their lowest since November —namely eight cases, and eight deaths; and the general mortality was normal. He (the Chairman) therefore hoped that, from this time onwards, there would be a substantial improvement in the Company's affairs. In conclusion, he moved a resolution adopting the report and accounts, and declaring a dividend of 3½ per cent., free of income-tax, making a payment of 6½ per cent. for the year.

Mr. F. L. Linging seconded the motion.

The Chairman, replying to questions, said the coal carbonized had not been cheaper. In 1896, coal and freight cost them £1 5s. 7d.; and in 1895, £1 1s. 7d. per ton—the difference being mainly on account of freight. On the other hand, less coal was used. The incandescent lights, which their Manager stated were three times as brilliant as the old lights, only consumed about 3½ cubic feet of gas as compared with 5 cubic feet. The Company's clerks in Bombay were natives; and it was very much to their credit that they stuck to their work as they did. There were five deaths among the native workmen. They were mostly Hindoos, Mohammedans, or Parsees.

The motion was unanimously adopted.

On the proposition of the Chairman, seconded by Mr. Magnus Ohren, Mr. Charles Gandon was re-elected a Director.

Mr. H. E. Jones, in moving that Major W. F. Gordon be also re-elected, remarked that this gentleman brought special experience to their counsels, having been long a resident in India.

Mr. E. A. Flinders having seconded the motion, it was agreed to.

The Auditors (Messrs. E. A. Flinders and Magnus Ohren) were also re-appointed.

Mr. Cuff moved, and Mr. T. S. Borradaile seconded, a vote of thanks to the Chairman and Directors—both gentlemen remarking upon the zealous manner in which the Board had contended with the difficulties of the year.

The motion was heartily agreed to.

Mr. Magnus Ohren then proposed a vote of thanks to the officers and staff, at home and abroad. He observed that on this occasion the thanks of the shareholders were especially due to Mr. Penny and the staff at Bombay. It would have been a great misfortune to the Company if many of their employees had left; and the shareholders must all be pleased to learn that they had so faithfully stuck to their work.

Mr. Whitley seconded the motion, which was cordially passed.

The Secretary, in responding, said it would be very gratifying to the staff to know their loyalty had been recognized by the shareholders in such a trying time.

This concluded the proceedings.

Godalming Water-Works Purchase Question.—The Godalming Town Council have appointed a Committee to reconsider the whole question of the purchase of the Water Company's works.

Sales of Shares.—Yesterday week, Mr. Alfred Richards sold, by order of the Directors of the West Ham Gas Company, 2000 £10 shares in the Company, ranking for a standard dividend of 7 per cent. per annum, subject to the sliding-scale; the last dividend on similar shares having been at the rate of 6½ per cent. per annum. The prices realized ranged from £14 10s. to £16 per share; the average being £15s. 7s. 3d., which would yield the investor £4 4s. 7d. per cent. The total amount produced by the sale was £30,723 15s. A parcel of shares and stock of the Dover Gas Company submitted to auction last Thursday realized £18 10s. per £10 share, and £97 2s. 6d. for £52 10s. of stock.

ELECTRIC LIGHTING NOTES.

With a courage that is simply admirable, the St. Pancras Electricity and Public Lighting Department have issued their annual report just before the election of the new Vestry. This document was presented at last Wednesday's meeting of the Vestry; and it is instructive reading. It appears that the total "lamps and other consuming devices" connected with the mains are: Lamps of 16-candle power, 25,649; arc lamps, 189; motors, 47—162 16-candle power lamps being applied for during the past year. The current is supplied by six engines and twelve dynamos; but it is sad to note that "considerable trouble has been caused by persistently recurring leakage of the boilers, notwithstanding the vigilance exercised by the makers." Nor is it encouraging to find that "a regrettable accident occurred to the arc lighting mains in August, resulting in an investigation as to the causes of the failure. After prolonged discussion extending into October, it was ultimately determined to re-arrange the existing arc lighting, so as to isolate each circuit from its neighbour, and to establish alternate lighting from the high and low tension mains, throughout both the existing and the new prospective lighting; thus obtaining double security against mishaps from failure of plant, and reducing the chances of a collapse to a minimum." Of course, the ratepayers cheerfully supplied the "needful" for these necessary alterations; and they will not be overjoyed to know that "the existing arc circuits have required very vigilant supervision and constant repair"—a peculiar attribute of all electrical contrivances. These little troubles, however, have not deterred the Committee from considering the question of an extension of mains to Highgate, though they admit that "the financial aspect of the question presents grave responsibilities." "Gas has been extremely troublesome in the culverts; no less than five instances having been reported both to the Gas Company and the Board of Trade, all of which were of a serious nature. The Gas Company have endeavoured to remove all leakages as promptly as possible. . . . On every occasion when gas has been prevalent, immediate steps have been taken to thoroughly ventilate the culverts; and the manhole lids have been kept open day and night till the influx has been satisfactorily dealt with."

The Committee reduced the price for electricity from 6d. to 5d. per unit for churches and chapels; and no less than six places of worship actually took advantage of this reduction during the year. We learn that "the use of electricity as a motive power in commercial undertakings is gradually superseding gas-engines;" the Committee proving this statement by announcing that a large local firm have erected a 20-horse power motor for the purpose of driving their extensive workshops. This firm have now "a number of motors supplied with energy from the department's mains; and it is gratifying to find that the experience of such an important firm has been so satisfactory as to induce them to bring this power into extensive use." This, strange to say, is the only example given.

Though the department are doing such a great work, the Committee have had to contend with cruel opposition in some quarters. For instance, the London County Council "severely criticize all our outlays, and spend a vast amount of their own time and the time of our officials in going into trivial details and demanding explanations. Hence we find ourselves, in May, 1897, without the loans which should have been completed in 1895. After all their ingenuity, the only sum to which the London County Council really object is that of £192 8s. 9d., out of a total capital expenditure of £109,931 up to Dec. 31, 1894. The loss and inconvenience caused to the undertaking is great. We have had thus to borrow largely from the bank; and we have had to pay at times much larger interest in consequence. We have had to supply a complete set of Ordnance Plans, showing in detail the electricity mains throughout the parish. We have had to carry on voluminous correspondence through our department; and the members of the Committee have suffered much annoyance and vexation. Unless things are very much altered in the near future, it may be the duty of the Committee to advise the Vestry to join with other parishes, who are in a like position with ourselves, to go to Parliament for power to borrow their money free of the interference of the London County Council."

As pointed out in the "Electric Lighting Notes" in the "Journal" for the 4th inst., the net result of the working of the Vestry's two stations is a loss of £800. The Committee, however, explain this to everybody's satisfaction by reminding the Vestry that "exceptional charges had to be met during the year for compensation and law charges, in connection with explosions in the culverts, which occurred in February, 1895, and the large expenditure involved for repairs to the arc lighting mains in consequence of the breakdown of the public arc lighting in August, 1896. Had these unexpected charges not occurred, the year's working, notwithstanding the loss on the King's Road station, would have resulted in a profit on the Vestry's undertaking as a whole, and not a loss."

In an appendix to the report, an endeavour is made to show that the accounts are not so unsatisfactory after all. Interest and repayment of capital costs 5·05d. per unit sold. This rate is described as "phenomenally high contrasted with other undertakings; Hampstead taking only 2·37d., and Brighton *nil* for this purpose." The Committee add: "It is evident that, while the works under control of this Committee are encumbered with the accumulated interest and repayment charges which other stations are allowed to transfer to capital account, comparisons cannot be instituted; and it is unfortunate for the records of the St. Pancras works that they appear in the technical press under such unfavourable conditions. Had our figures been dealt with in a similar manner to Brighton's and other works in their initial stages, the result of the year's working of the combined stations would have shown a handsome profit."

Mr. Lazarus did not scruple to describe the report as a miserable one, and to express his great sympathy with the Committee. But Mr. Edward Cox-Sinclair, the Chairman of the Committee, is as sanguine as a Chairman should be; and, after showering complimentary epithets on Mr. Sydney W. Baynes, the Chief Electrical Engineer, he says: "I believe we can reasonably hope there is a bright future in store for us. It is almost impossible to over-estimate the importance of our work and the extent of the responsibility which it involves. We have in our hands the management of an important commercial undertaking, in which a large amount of public money is invested, and from which a large measure of public service may reasonably be expected to accrue. I venture to think that when the various extensions and improvements

which have been sanctioned by the Vestry during the past twelve months have been carried out, the undertaking will be in a thoroughly sound condition, and will be able to be worked, not only with additional economy, but to the ever-increasing advantage of the ratepayers of the parish of St. Pancras." The ratepayers are now waiting for the genesis of that "ever-increasing advantage."

In order to encourage the use of electric lighting, the Walsall Corporation have agreed that consumers shall be charged only 2d. per unit (instead of 6d.) for all electricity used over the maximum. There was some opposition to the proposal on the grounds that it would introduce differential rates, and might injure the gas undertaking.

The proposal of the Hull Town Council to borrow £52,000 for electric lighting purposes has been under the consideration of Colonel J. O. Hasted, acting on behalf of the Local Government Board. From the statements laid before him, it appears that the present plant is likely to prove inadequate for the coming winter; and it is therefore desirable to make some extensions. It is proposed to erect a new generating-station and sub-stations.

The Worcester City Council have passed a resolution expressing their willingness to enter into an agreement for five years with the Electrical Free-Wiring Syndicate. It is considered that the wiring of houses upon the conditions proposed by the Syndicate will be advantageous to the Corporation; and they are therefore arranging to allow them a supply of electrical energy at a reduced rate. It is stated that the Syndicate intend spending £20,000 for the requirements of the city.

According to the report of the Borough Accountant of Southport for the year ending March 31, there is a deficit of £471 on the Electricity Department. The amount expended on generation, distribution, interest, sinking fund, &c., was £5094; and the income from the sale of current, meter and other rents, &c., was £4623. As there was a credit balance of £302 brought forward, the net loss on the department from the commencement is £169. A sum of £678 disallowed by the Local Government Board from capital account is still in suspense.

The extension of the electric lighting works at Hanley has been the subject of an inquiry by Col. J. T. Marsh, on behalf of the Local Government Board, whose sanction is required by the Town Council to a loan of £15,000. It was stated that, if this is granted, the total capital will be £61,110; that the demand for the light has been so great that it has almost reached the maximum the works can supply; and that the number of meters at present in use is 262. It is proposed to use £1000 of the new loan in carrying out a system of "hire purchase."

Our readers are aware that a change has come over the electric lighting question at Newmarket; and, as already mentioned, it is not improbable that a scheme will be carried out by one of the firms who are willing to take over the Council's Provisional Order. In the meantime, the Directors of the Gas Company have shown unmistakable signs of enterprise by announcing in the local paper, in very prominent type, that if electric light installations are required, they are prepared to furnish them, and to supply gas-engines for working them, at cost price. As the Company sell at a reduced rate all gas used for motive power, the introduction of what is generally called the "rival illuminant" may prove to be a blessing in disguise.

The Sunderland Town Council last Wednesday agreed to expend £1853 in extending their electricity distribution system, and £1900 in the erection of fifty 600-candle power arc lamps in four of the principal thoroughfares. It was stated by Alderman Bruce that the contract with the Gas Company for the lighting of the town would soon expire; and the Company had already intimated that, in consequence of advances in wages, an increased price would be demanded in the new contract. They had also given notice that, if the electric light were introduced into any streets, an increase of 6d. per lamp would be charged for gas. The Highways Committee, he added, hoped to persuade the Company not to put themselves into such an invidious position as they would occupy by opposing the electric light in such a manner.

Now that they have acquired the electric light undertaking, the Exeter Corporation are discovering that gas is unsuited for many purposes for which it answered so long as the electricity works were in the hands of a private Company. The other day, it was street lighting; now it is the illumination of public buildings for the Jubilee celebration. At last Wednesday's meeting of the City Council, the Electric Lighting Committee asked for a grant of funds for the illumination of the Guildhall and other places. They were fortified by a report from the City Surveyor to the effect that gas is too hot for the stonework, and the heavy gas-fittings cause damage to it. As the Guildhall is a building of considerable antiquity and of much historic interest, the Councillors were alarmed at the prospect of any harm happening to it; and the appeal of the Electric Light Committee was answered in the affirmative. A further suggestion from the same quarter that the gas devices which the Corporation possess for illuminating purposes should be disposed of was also carried, though not without doubts, implied and expressed, on the part of some of the members. One feared that the electric light works might prove incapable of meeting the demand for current and illumination purposes; and he asserted there has been general and just complaint of very bad lighting on recent evenings. The reply of the Chairman of the Committee was that an addition was about to be made to the plant, which would alter all. The suggestion of another member, that the gas devices might be kept until it was seen how the new scheme answered, was as lightly brushed aside; and the gas devices are to be sold.

Street lighting by electricity is to be largely extended in Bristol; and for this purpose 200 additional arc lamps will be required. According to a report submitted at last Tuesday's meeting of the Bristol Town Council, there are now in use 103 arc lamps; and their cost is about £35 per lamp per annum, or a total of £3690. The cost of lighting by gas the streets now proposed to be lighted by electricity is about £2400; making, with the sum of £3690, a total cost for lighting of £6090. The Electrical Committee state that if 200 additional arc lamps are erected, the cost of the 303 lamps (inclusive of the provision and maintenance of machinery and plant, the generation of electricity, and all other expenses) would not exceed £23 per lamp per annum, or £6969. This sum would therefore exceed by only £879 the present cost of lighting, amounting to £6090, as before mentioned. The report was adopted. The foregoing figures have been questioned by the Secretary of the Bristol Gas Company (Mr. John Phillips) in a letter to one of the local papers. He says that the fact are that electricity in the present area costs £3690, and the gas now used on the proposed extended area comes to £1765—together, £5455. Here we have a difference of £635. Then the Committee put the extra cost of lighting over the whole area, at the reduced charge of £23 per lamp, at £879; whereas Mr. Phillips makes it £1445. The cost of lighting the present area is £2300; the added area will come to £4600—together, £6900, against his £5455. The Committee give the present cost of gas in the proposed extended area as £2400; whereas its actual cost, as stated above, is £1765. The total extra cost of electricity over gas when the whole of the proposed area is lighted by electricity (taking the electric lamps at the promised reduction and gas at the present price) will, according to Mr. Phillips, be £4072. This he shows as follows: Cost of electric light on the present and the extended area, £6900; less cost of displaced gas-lamps in present area £1063, and in extended area £1765—together, £2828. He closes his letter by pointing out that, as the ratepayers are to have the improved lighting, it is as well that they should know the exact price to be paid for the luxury.

An application by the Corporation of Canterbury to the Local Government Board for power to borrow £23,000 for providing an installation of the electric light, and £750 for the purchase of land, was the subject of a long inquiry by Major F. H. Tulloch last Tuesday. The scheme was opposed. The Town Clerk (Mr. H. Fielding) gave a history of the electric lighting question in Canterbury since 1890. He said the Town Council had carried on negotiations with the Brush Company for some time; but as the latter were unable to float a local Company, the matter dropped. In August, 1895, the Council called in Mr. R. Hammond, who prepared a scheme; and on May 2, 1896, they decided, on the recommendation of a Committee of the entire body, to ask for £23,000 to carry it out in an extended area. Mr. Fielding urged that in every town where an electric lighting installation was owned by the Council, the undertaking had been a success. The opponents of the scheme thought the Provisional Order should be transferred to a private Company; but this would only enhance the cost of the concern. They also pointed out that any loss would fall on the ratepayers; but they said nothing about the profits aiding in the reduction of the rates, instead of going to the shareholders. The opposition really came from the Gas Company; and the plea that there was no demand for the light was best answered by the fact that two private Companies were anxious to get the lighting powers into their own hands. The Mayor had been asked to poll the city on the question; but he (Mr. Fielding) had strongly objected to such a course. The population of Canterbury was 23,000; the rateable value, £95,000; and the outstanding loans, £40,000. These figures compared very favourably with those of any other town in England. Mr. R. Hammond, M.Inst.C.E., gave particulars of the scheme proposed to be carried out. He stated that all the electric lighting stations equipped on modern lines were working successfully except the one at Burton-on-Trent. In electric matters, the supply created the demand; and Canterbury was essentially one of those places in which electric lighting would prove a great boon. He proposed generating plant for 5000 lights, equivalent to 7000 fixed on circuit, and full reserves of batteries capable of sustaining a load of 1500 lights for three hours, or 375 lights twelve hours. There would be boilers in duplicate, each capable of running the full generating plant. In cross-examination, Mr. Hammond said it was not his experience that the first estimate was generally exceeded. This was very rarely the case. It cost from 12s. 6d. to 15s. to instal the electric light in a shop, and 22s. 6d. in a house. The failure to make electricity pay at Yarmouth was owing to the lowness of the price charged—2¼d. per unit. The City Surveyor (Mr. A. Campbell) gave details of the proposal to utilize the waste heat from the city dust destructor for the economical production of the electric light. He was cross-examined as to other works of public improvement necessary in Canterbury—such as drainage, the abolition of slums, improvements at the sewage farm, baths and wash-houses, the removal of the cattle market from the centre of the town, and other matters—which had been discussed and recommended, but not proceeded with on the ground of the expenditure involved. The Inspector expressed surprise that, if these works were of importance, the Corporation, with a debt of £40,000 and borrowing powers equal to double the amount, did not carry them out. Mr. H. F. Dickens, Q.C., then addressed the Inspector on behalf of certain opponents of the scheme. He said the Council had not moved in this matter before because they were afraid; and they were also afraid of testing the feeling of the ratepayers on the question, as had been done at Maidstone and elsewhere, or they would not have allowed the Town Clerk to veto the proposal for a poll. The demand for the light came from a selfish few, who, feeling that it might be of assistance to them personally, would like to make the whole city pay for it. Mr. Hammond's scheme was based on possibilities; and his report contained figures with which it was impossible to deal. But taking local authorities alone, out of 40 which had been mentioned, 26 had made a deficit, which was a considerable criterion. There were other works required in Canterbury of far more importance than the electric light, but they had not been carried out owing to the agricultural depression which had prevailed; and those whom he represented said that the electric light was, under the circumstances, a luxury they did not require. Evidence having been given in opposition, Mr. Mowll, as representing Messrs. Edmundsons, Limited, said his clients opposed the application. They had offered the Corporation very reasonable terms, but had been refused an opportunity of carrying out the Order. Mr. Hammond had stated that the profit on schemes with which he had been connected had worked out at 7¾ per cent. gross; but he had carefully omitted to say what the net profits were. At the close of the inquiry, the Inspector said he would report to the Board,

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Reductions in Price.—The Pudsey Gas Company have decided to reduce the price of gas to 2s. 6d. per 1000 cubic feet from the beginning of next quarter. The Directors of the Maldon Gas Company have resolved to allow a discount of 5d. per 1000 cubic feet on prompt payment of account, which practically means a reduction in price to 2s. 2d. per 1000 cubic feet. The Bideford Gas Company have reduced their price 2d. per 1000 cubic feet as from the 31st of March. The Cannock and Hednesford Gas Company, Limited, have given notice of a reduction of 5d. per 1000 cubic feet in the price of gas. The demand for gas is steadily increasing in both districts.

NEW WATER-WORKS FOR HAVERHILL.

On Thursday, the 6th inst., the new water-works for the supply of Haverhill, commenced rather more than three years ago, were formally opened. They have been carried out in accordance with the plans of Mr. J. Kemp, Assoc.M.Inst.C.E. (at one time the Town Surveyor, and now of Hampton), altered at the suggestion of Mr. Radford, who was consulted by the District Council. They comprize a covered reservoir to hold 150,000 gallons; two settling-tanks, each of a capacity of 100,000 gallons; a neat engine-house; a commodious cottage; and four miles of mains. The well, which is in the engine-house, has a depth in brick of 103 feet, with a bore of 150 feet; making a total of 253 feet. It is 7 ft. 6 in. in diameter, and the bore is 8 inches. The work has been carried out at a cost of £10,000 under the superintendence of Mr. T. Cockrill, Assoc.M.Inst.C.E., the present Surveyor, with Mr. W. L. Catlin as Clerk of Works. The capacity of the plant enables 10,000 gallons of water an hour to be pumped from the well into the settling-tanks, and 10,000 gallons an hour out of the settling-tanks into the high service reservoir or directly into the main. An important feature is that the water is pumped direct from the chalk, and is delivered to the consumer as pure as when obtained from that source. The motive power is supplied from the gas-works of the District Council, and is utilized in two "Otto" gas-engines each of 12 nominal horse power. Special interest attaches to the pumping machinery, which was supplied by Messrs. Crossley Bros., Limited, of Manchester, inasmuch as it embraces the first installation in the world of a system of pumping invented by Mr. J. Atkinson, who is in the service of the firm. Mr. Atkinson was present at the opening of the works, and explained that the principle of his system is the forcing of the water from the well by means of a body of air which is alternately compressed into one chamber and exhausted from another. When the latter chamber is filled, an automatic valve—really the kernel of the invention—reverses the suction and compression, so that the chamber which was last filled is discharged by compressed air, and the pressure that remains in the discharged vessel is brought back into the air compressor; consequently the power is not lost. From a hygienic point of view there are several advantages accruing from the system. All the machinery is in the engine-room, and there is nothing moving in the well, so that there is no necessity for any lubrication therein. Further, there are no belts, clutches, or gearing, which are often a source of trouble. The inaugural ceremony was performed by Alderman Gurteen, J.P., the Chairman of the Council, after which the machinery was inspected. Subsequently a visit was paid to the settling-tanks, into one of which water was being pumped at an estimated rate of 150,000 gallons per hour. Refreshments were provided by Alderman Gurteen; and "Success to the Water-Works" was heartily drunk. He said he thought they would find that the works had been carried out none too soon, and that eventually they would be no burden upon the rates.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The municipalization of gas undertakings goes on with such rapidity in Scotland, that it may almost be said that we are within measurable distance of the time when there will scarcely be a gas company left. The latest proposal is that the Corporation of Kirkcaldy should take over the undertaking of the Kirkcaldy Gaslight Company; and it was so well received by the Town Council this week, that it will be a surprise to me if it is not an accomplished fact as soon as the necessary negotiations can be got through. The subject came up in a natural way. It appears that the Council were desirous of adjusting terms with the Company for the supply of gas for the public lamps; and that the Town Clerk had, by request, written to other towns to ascertain the rates of discount allowed. When the replies came in, they were laid before the Finance Committee. It was then discovered that in 24 towns, including all the larger ones, the corporations owned the gas undertakings; and that, in such places, the question of discount was a small matter. Probably there were not replies from every place where the corporations own the gas supply; for, as a matter of fact, there are 39 or 40 municipal undertakings in Scotland. There are in all about 250 gas undertakings in Scotland; and consequently about one-sixth of them are under municipal control. The Finance Committee of the Kirkcaldy Corporation, when they considered the replies, came to be unanimously of opinion that the proper course for them to follow was to also acquire the gas-works. They accordingly so recommended. Provost Hutchison introduced the subject at the Town Council meeting on Monday. He said the step proposed was certainly a most important one; but he thought it one that had been delayed too long. It was a step they would have to take sooner or later; and the sooner the better. They had no fault to find with the Gas Company in the way they had managed their business, as they deserved credit for what they had done; but this was not the point. The question was: Was it right for a private company to supply gas to a town with a population so large as that of Kirkcaldy? He contended that the town should own its own gas-works, in the same way as it owned its water-works; and he did not see how it could be any loss to the community were they to take over the gas-works and supply the town with light. Councillor J. Robertson moved the approval of the minute and the Committee's recommendation, which proposal was seconded by Councillor Orr. Bailie Tait said that the electric light was coming to the front, and was gradually getting cheaper; and there was consequently a danger of taking over the gas-works and saddling the community with a heavy burden. He therefore moved for delay. Councillor Black seconded. Provost Hutchison, in reply, admitted that it was only right the electric light should be introduced into Kirkcaldy; and as a Corporation they could arrange for it as well as the gas. On a vote being taken, the approval of the minute was supported by 24 votes; the amendment being supported by only the mover and seconder. In the course of the discussion, it was pointed out that the price of gas in Kirkcaldy at the present time is 2s. 11d. per 1000 cubic feet—the lowest rate at which it has ever been. I think this is the first occasion on which a gas transfer has been proposed without the proposer giving, as his reason for moving, that the community were being badly treated by the gas company. There is all the more pleasure, consequently, in referring to the matter. It could scarcely, however, be otherwise. The Kirkcaldy Gas-Works have long been most excellently managed by Mr. A. MacPherson, as the low price of gas shows; and the community have been so well served by the Company that there is no ground for attack. Of course, if the councillors were not a body of level-headed gentlemen, this would be no reason for acting fairly by the Company; but being so, they have approached the subject in the proper spirit. They have appointed a Committee to inquire into the proposal, and to report. If this Committee approach the subject in the same spirit of fairness as the Council, there should be little difficulty in adjusting terms. It is very probable, however, that the sum to be paid may not be so easily agreed upon by the two bodies; but if common sense can be preserved, arbitration will soon fix the amount. There have been so many arbitrations in Scotland of late years, that it should be an easy matter for a tribunal anywhere nowadays to ascertain the value of a gas undertaking. I observe that the Company, while selling gas to the community at 2s. 11d., supply it to the Corporation for the public lamps at 2s. 2½d. per 1000 cubic feet.

Matters are not working very smoothly in the Dundee Gas-Works. There is some friction between the Manager (Mr. William M'Crae) and the Analyst (Mr. Donald). I think I foreshadowed as much at the time the then Gas Committee created the office of Analyst, because of their making the Analyst an independent appointment, and not under the control of the Manager. The subject came up at a meeting of the Town Council this week. The Council are promoting a Bill in Parliament, part of which relates to the gas undertaking; and necessarily the services of Mr. M'Crae will be required before the Parliamentary Committees. The question was asked in the Town Council, who would manage the works when Mr. M'Crae was in London. The motion was made that Mr. Donald be appointed. Mr. Brownlee, as Convener of the Gas Committee, said he was prepared to second the proposal; but he had found that the two gentlemen were on such bad terms, that it would be madness to make any such appointment. He had therefore explained to the Committee that he could not see his way to the proposal. It was the Analyst who was pressing this matter. He would have been very glad to assist the Analyst in the way of promotion; but he must learn to keep on good terms with those who assisted him. When the parties were reconciled, the Council should not appoint the Analyst as Assistant Manager, but as *ad interim* Manager. He moved that the whole matter be remitted to the Gas Committee. Regret was expressed that publicity should have been given to the circumstance, to which Mr. Brownlee replied that he had been asked why he had not had an appointment made, as promised some time ago; and he was obliged to give his reason. The Council, by 16 votes to 10, left the matter in the hands of the Committee. It is greatly to be regretted that there should be any difficulty with the staff in the gas-works; but the Council have the remedy in their own hands. It is quite proper for the Analyst to desire to be put in the way of promotion; and I understand that his position is that, if he does not get this appointment of *ad interim* Manager, it must go to a working man, which would be unfair to him, he being a man of education. I certainly sympathize with this view. But then, it would scarcely be fair to Mr. M'Crae that the Analyst—who is, as it were, placed there to be a check upon him—should have the command of the works in his absence. The Analyst is not responsible for the position in which he is; and the way out of the whole difficulty would probably be to place Mr. Donald under Mr. M'Crae permanently—giving him the title of Assistant Gas Manager and Analyst.

The Dundee Town Council are giving practical illustration of the truth of the statement that a municipal gas undertaking is not generally so well managed by a Committee of a Corporation as by a specially appointed Commission. The coal contract question was before the Council this week, on the recommendation of the Gas Committee to purchase 57,000 tons of coal. Bailie Mathers said that a Sub-Committee had allocated the contracts; whereas he understood that this should have been done by the whole Committee. Out of 104 offerers, 13 had been selected. He had gone over the first four successful offers; and as he found that they were not the lowest, he wished to know why these contracts had been accepted. In these four contracts 12,500 tons were involved; and there was an apparent loss of £433 6s. 8d. If the other contracts were at all in proportion, the loss to the city evidently amounted to £1000. He moved that the subject be sent back to the Gas Committee. After some bandying of words, for which there did not seem to be any occasion, this was agreed to. The Committee met a day or two afterwards, and resolved to abide by the recommendations of the Sub-Committee. This will probably lead to some more wrangling.

The Manager of the Broughty Ferry Gas-works (Mr. A. Waddell) reported to the Commission that the capacity of the three gasholders which they possess is 150,000 cubic feet, which is equal to 75 per cent. of the maximum day's make. He is of opinion that the storage should be increased; and he pointed out three ways in which this could be done: (1) By erecting a new two-lift holder of 215,000 cubic feet capacity, at a cost of £4958; (2) by taking down the middle holder, and erecting a new two-lift holder of 325,000 cubic feet capacity, at a cost of £6061; and (3) by adding two lifts to the present east holder, thereby affording additional capacity to the extent of 165,000 cubic feet, at a cost of £1738. The existing site is valuable; and Mr. Waddell considers it would be advisable to utilize it in the matter of extensions in such a way as to postpone as long as possible the necessity for procuring additional ground elsewhere, as divided works have disadvantages. The second and third plans, he considers, would do this. The report has not yet been considered by the Commissioners.

The fire at the Broughty Ferry Gas-Works (to which I referred last week), was the subject of conversation at a meeting of the Police Commissioners on Monday. The Gas Commissioners recommended that the oil-storage plant be removed from the retort-house to the south end of the open yard. This brought up a member who considered that the report was very unsatisfactory, and that the fires which had taken place at the works from time to time made it necessary that something should be done to investigate the whole circumstances. He concluded by moving that an expert be engaged to examine into, and report upon, the construction and position of the oil-gas plant, the proposed additional gas-

storage schemes, and the advisability of discontinuing the manufacture of oil gas. Nothing short of this would restore public confidence. Mr. Maclaren, the Convener of the Gas Committee, had no objection. In reply to a question, the Manager admitted that fires had occurred in gas-works where oil was used—Lasswade, Barrhead, and Brechin. The motion was unanimously agreed to; and it was decided that Mr. J. Hepworth be invited to make the investigation.

I learn of an explosion of gas which took place at Motherwell on Wednesday night, in connection with which it is ingenuously stated that the occupier of the house had been running water off the meter, after which he left it for a time, and then returned with a light, when the explosion occurred. It was rather a violent one. The point of this paragraph is, however, that the man had no right, under any circumstances, to run water out of the meter. But it is well known that, where it can be done, it is done regularly. One of my earliest recollections is that, in many houses, as soon as the man who read the gas-meter and adjusted it had left, a quantity of water was run off, by which means it was thought that more gas was obtained than was registered. This Motherwell man seems to hold to the same notion.

The House of Lords Committee on the Stirling Gas Bill is to be presided over by Lord Hawkesbury. Ten Bills have been remitted to the Committee; and of these the Stirling Bill is the sixth. It is expected to be reached about the middle of next week. The Caledonian Railway Company have withdrawn their opposition; and there now only remains that of a section of the residents in the town, who have been organized by the Ward Committee. The Corporation are to be represented by Mr. Littler, Q.C., Mr. Forbes Lankester, and Mr. John Wilson, of Edinburgh. Mr. Wilson, the Scotch Counsel, is the son of the Town Clerk of Falkirk, and was engaged in the Falkirk arbitration. The opposition are to be represented by Mr. Jas. Todd, a Fifeshire gentleman, practising as a barrister in London. I know Mr. Todd; and am satisfied that he will do justice to his clients. But I am afraid he is engaged in a hopeless task; and I should not wonder if his appearance before the Committee should be a brief one.

The Dunfermline Police Commissioners, with a view to encouraging the use of gas for cooking, have instructed their Manager (Mr. Hubert Pooley) to supply and connect small gas-cookers, at an approximate cost of £1 1s. each, to be used in connection with prepayment meters, and for which no rent will be charged.

Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, have completed the new wire-rope guided gasholder for the Perth Gas Commission; and on Monday of this week, the Gas Commissioners authorized payment of the balance of the price. In terms of the contract, the last payment is deferred till three months after the completion of the work. At the meeting on Monday, the Manager (Mr. A. Wilson) reported that the output of gas during the month of April was 7,519,000 cubic feet, which was 874,000 cubic feet more than in April of last year. The increase in the output was equal to 13·15 per cent. There was an increase of 18·85 per cent. in the quantity of gas consumed during April. Over the period of the year which has elapsed, the increase of gas consumed is equal to 8·59 per cent.

Walsall Corporation Gas-Works.—The assessment of the Walsall Corporation Gas-Works has been increased from £3131 to £5809; and the Town Clerk has been instructed to deal with the matter.

The Detection of Water Leakage and Waste at Worcester.—By a majority of one, the Worcester City Council have passed a recommendation for stopcocks and Deacon's waste-water meters to be provided in the city, at an estimated cost of £1750. It is believed that the adoption of this means of detecting waste will save the Corporation entering upon a large expenditure in connection with the water-works.

The Deacon Waste-Water Meter System at Ince.—A splendid testimony to the utility of the Deacon waste-water meter system comes from Ince. According to a statement made at the last meeting of the District Council, when the meters were first put to work, the consumption of water was 22 gallons per head per day; and it has been brought down, by the discovery of leakages, to 11·8 gallons. It is believed that the consumption will be eventually reduced to something like 7 or 8 gallons. It is estimated that the saving in the payment to the Liverpool Corporation for water will be nearly £600.

The Purchase of the Matlock Bath Gas-Works.—One of the final stages in the acquisition of the Matlock Bath Gas Company's undertaking by the District Council was reached last Thursday week, when the Arbitrator (Sir William Coddington) sat a second time to adjudicate. The price for the works, £16,736, had been paid; but nothing appeared as to the book debts of the Company. These the purchasing authority claimed under their Act. The Company, however, opposed; and the Council afterwards expressed themselves willing to pay a price to be fixed by the Arbitrator. Sir William gave judgment for the payment of £807, and the delivery of the books to the Council forthwith.

Darwen Gas and Water Affairs.—The Chairmen of the Gas and Water Committees of the Darwen Corporation submitted their annual statements at the last meeting of the Council. Alderman Davies, in moving the adoption of the minutes of the Gas Committee, referred to the satisfactory character of the report, showing as it did a profit on the year's working of £3717. During the year 148,506,000 cubic feet of gas were consumed—an increase of 11¾ millions, which he thought was about the largest they had every experienced, and was mainly due to the demand for gas-stoves and prepayment meters. There was a decrease in the quantity of gas used for illuminating purposes to the extent of 120,000 cubic feet, which was no doubt saved by the use of incandescent lamps. He also announced that the Committee had agreed to reduce the price by 3d. per 1000 cubic feet; it being their opinion that a lower price would induce a greater consumption. In proposing the confirmation of the minutes of the Water Committee, Alderman Duxbury stated that, for the first time in the past five years, his department showed a profit. During the twelve months, a profit of £929 had been made, as against a loss of £3 in the previous year. The daily domestic consumption of water was 9¼ gallons per head, while ten years ago it stood at 17¾ gallons; so that practically it had been reduced one-half. The minutes of both Committees were confirmed.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 15.

Sulphate of Ammonia.—There has been a firm market throughout the week; and a further improvement in values at West Coast ports has to be recorded—the closing quotations being £7 10s. to £7 12s. 6d. per ton f.o.b. Hull and Leith, and £7 15s. per ton f.o.b. Liverpool. Fresh export orders have only been moderate; but the heavy drain occasioned by the home consumption, and by exceptionally large shipments from Liverpool and Glasgow during the past month, has left makers in these districts rather bare of stocks, and correspondingly firm in price for supplies for near delivery. The home demand is tailing off. There is much speculative offering in the forward position, at a substantial discount on spot prices for the autumn months. Makers, however, for the most part abstain from offering ahead—stocks in the hands of the large holders having been reduced to more manageable compass, and prices obtainable offering very little inducement to sell for forward delivery.

Nitrate of Soda.—There has been a slump in the Hamburg market; and the U.K. has been more or less prejudiced—closing quotations being 7s. 9d. per cwt. for ordinary, and 7s. 10½d. per cwt. for fine quality, *ex* store on the Mersey.

LONDON, *May* 15.

Tar Products.—This market, excepting carbolic acid and solvent naphtha, is in a bad way; and the prospect for distillers, who have paid high prices for tar, is very serious indeed. Benzols have suffered a complete collapse, especially as regards nineties—a large business having been done in this grade at 1s. 6d. Anthracene goes from bad to worse; and business is reported in London quality at 6d., while there appears to be no market for "B" at any price. Pitch is also weaker; and buyers are holding off for lower prices. Complaints are frequent that the tar products market is in the hands of speculative dealers; but it is impossible to believe that this general falling off in values can be due to the operations of middle men. It looks as if there is too much benzol, anthracene, and pitch being made; and, if this be so, we may yet see lower prices. As regards anthracene, the rapid fall has been more or less accentuated by the forced sales mentioned a week or two ago.

The following average values may be taken as representing to-day's business: Tar, 14s. 6d. to 18s. 6d. Pitch, 20s. to 22s. Benzols, 90's, 1s. 6d.; 50's, 1s. 11d. Toluol, 2s. 3d. Solvent naphtha, 1s. 7d. Crude, 30 per cent., naphtha, 11d. Creosote, 1¼d.; liquid, 2d. Heavy oils, 35s. Carbolic acid, 2s. 6d. Pressed naphthalene, 60s. Creosote salts, 22s. 6d. Anthracene, "A," 6d.; "B," nominal, 5d.

Sulphate of Ammonia is in better request. Considerable shipments are being made to markets which have not formerly taken large quantities. Buyers are realizing at last that the nitrogen value of sulphate of ammonia makes it worth buying, with nitrate of soda, containing one-fifth less of nitrogen, at a higher price. There is a decided firmness all round; and at some ports an advance in value. £7 10s. to £7 12s. 6d., less 3½ per cent., represents business at all ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Although there are moderate inquiries stirring for gas coal, the actual transactions put through are only comparatively small in weight, and scarcely sufficient to establish definite prices. The tendency, as previously noted, is towards some hardening upon last year; but there does not seem to be much expectation that any very appreciable advance will be got on 1896 prices—at any rate, on the important contracts. The backwardness of the season is, however, strengthening the position of colliery owners; and they will start with considerably less stocks than last year. Pits, as a rule, are kept working practically full time; and the output is moving away without much difficulty. Prices for the better qualities of round coal are steady at about 10s. to 10s. 6d. per ton for best Wigan Arley; 8s. to 8s. 6d., for Pemberton four-feet and seconds Arley; and 6s. 6d. to 7s., for common house coal at the pit mouth. Steam and forge coals are also in fairly active demand; but supplies are ample, and prices low—averaging about 5s. 9d. to 6s. 3d. per ton at the pit. Engine fuel meets with a ready sale, and rates are hardening; colliery proprietors asking advances of fully 3d. per ton on forward contracts. The increased production of slack, however, is checking any appreciable actual advance on late rates; and the average figures, at the pit mouth, remain at about 3s. 3d. to 3s. 6d. per ton for common slack, 3s. 9d. to 4s. 3d. for medium, and 4s. 9d. to 5s. for best qualities. A moderate business is reported in the shipping trade; but ordinary steam coals are still obtainable at about 7s. 6d. per ton delivered at the ports on the Mersey.

Northern Coal Trade.—Though the delay of some of the steamers has lessened the shipments of coals this week, the general tone has been steady, and there has been a fair working for this season of the main collieries. Best Northumbrian steam coals have met a good demand, and are quoted at from 8s. 6d. to 8s. 9d. per ton f.o.b. Second-class steam coals are 8s. to 8s. 3d. per ton; and steam smalls, 3s. 9d. to 4s. Manufacturing coals are steady. In the gas coal trade, the local demand is now necessarily very limited. But the exports are heavier; and thus some of the collieries that export largely have very full work. One or two contracts have been allotted this week. In most cases, the basis of the price for best Durham gas coals is 6s. 6d. to 6s. 9d. per ton; and the latter figure is about that which is current for sales of occasional cargoes. There is no alteration of moment to record this week in the gas coke trade.

Scotch Coal Trade.—Great activity still continues in all branches; and prices, particularly for ell, are tending to get firmer. Some foreign contracts have been secured, which will give work throughout the year to the miners, and help to keep them in full time and contentment. This contracting forward is looked upon as an indication of returning prosperity. The prices quoted are: Main, 6s. 3d. to 6s. 6d. per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; and splint, 6s. 9d. to 7s. The shipments for the week amounted to 155,867 tons—a decrease of 11,127 tons on the preceding week, and of 24,981 tons on the corresponding week of last year. For the year to date, the shipments have amounted to 2,488,915 tons—an increase of 94,153 tons over the same period of last year.

Slough Gas Company.—The half-yearly accounts of the Slough Gas Company show that the income amounted to £3136; and the expenditure to £2175—the balance being £961. This has allowed of the declaration of the usual dividends.

A Water Scheme for St. Agnes.—Last Tuesday week, Mr. Walter A. Ducat, held an inquiry at St. Agnes relative to an application by the Truro Rural District Council for power to borrow £3000 for carrying out a water scheme for St. Agnes. A proper water supply, it seems, has been required for a long time; and the establishment of sewage works has increased the necessity for a supply. The Medical Officer (Dr. Bonar) states that he is satisfied that nine-tenths of the wells from which the present supply is derived are suspicious. Opposition was raised to the scheme on the ground that it would not supply the whole parish.

Suicide by Coal Gas.—The Deputy Coroner of Halifax (Mr. J. E. Hill) held an inquest last Tuesday on the body of Edith Lees, aged 22, the daughter of an accountant, of Bon Trees House, Wheatley. It appeared that the deceased retired about 10.30 on the previous Saturday night; and next morning it was found that the door of her room was locked, which was unusual. For some few weeks, Miss Lees had been somewhat depressed; and her father, fearing something was wrong, obtained admittance into the room through the window. The smell of gas was almost unbearable; and he discovered the burner off the bracket, and the tap turned full on. Over the door a blanket had been fastened. Miss Lees was unconscious, and died before a doctor arrived. She was engaged to be married; and no reason could be assigned for her rash act. The Coroner thought the jury would have no difficulty in coming to the conclusion that Miss Lees died from suffocation by gas, and that she had committed suicide. The jury returned a verdict to that effect.

Ipswich Corporation Water Department.—In the annual report presented by the Water Committee at the meeting of the Ipswich Town Council last Wednesday, it was stated that the actual profit for the twelve months had been £978. Adding this to the balance, £5667, brought forward from the preceding year made a total of £6654. Out of this amount, £2300 had been transferred to the credit of the general district rate; leaving a balance of £4354 to be carried forward. Out of this a further £1000 is to be placed to the credit of the general district rate. In view of the increasing profit earned by the undertaking, the Committee recommended that a rebate be given to all consumers, other than for trade purposes, for the current year at the rate of 10 per cent. per annum; the allowance to come off the second half-yearly payment of the rate. The report also mentioned that a contract had been entered into for the supply of a new pump and steel boiler at a cost of £3995; and an additional £600 would have to be spent in altering the works. In the course of the debate on the report, it was mentioned by Alderman D. Ford Goddard, M.P., that the water-works had turned out an exceedingly good investment—much better than was ever anticipated when first purchased. In the estimate then made, he placed the revenue for the present year at £8600; and many thought that this statement was *couleur de rose*. But as a matter of fact, the undertaking had been so successful that the revenue for the year amounted to £9180. The report was adopted.

New Loan for the Middleton Gas-Works.—The Middleton Town Council have received the sanction of the Local Government Board to the borrowing of £30,000 for gas-works purposes.

Increased Storage at the Goole Gas-Works.—The ceremony of turning the gas into the large new holder at the Goole Gas-Works was successfully carried out last Thursday by Mr. R. Jackson, the Chairman of the Gas Committee, in the presence of most of the members of the District Council; the Manager, Mr. J. Bellhouse; Mr. W. Newbigging, of Messrs. T. Newbigging and Son, the Engineers of the Council; Mr. Clayton, of Messrs. Clayton, Son, and Co., the Contractors for the iron-work; and Messrs. Jackson, the Contractors for the tank. Mr. Elliot, of Goole, was Clerk of the Works throughout.

The Water Supply Scheme for the Brampton District.—Regarding the scheme which the Brampton District Council have adopted for the supply of Castlecarrock, Hayton, and Irthington, as recently reported in the "JOURNAL" (p. 673), parish meetings at the first and last named places have objected to it on account of the unnecessary and great expense; and the Local Government Board are to be memorialized not to sanction the proposal, or at least to postpone their decision until the Carlisle Town Council have matured their new scheme, when it is expected that Castlecarrock will be provided for at a lower cost than under the present scheme. Hayton has not yet pronounced an opinion on the subject.

Widnes Gas and Water Supply.—According to the minutes of the Gas and Water Committee of the Widnes Corporation which were presented at the meeting of the Town Council last Tuesday, the Engineer (Mr. Isaac Carr, Assoc.M.Inst.C.E.) reported that in the four weeks ending April 28, the quantity of gas sent out was 12,536,000 cubic feet, as compared with 9,257,000 cubic feet in the corresponding month last year; and of water, 63,464,195 gallons, against 57,625,382 gallons. He also reported that the sulphate plant had worked during the whole of the month, and that 30 tons had been sold—leaving 60 tons in stock. The local sales to farmers during the present year had been 55 tons, as compared with a total of 31 tons last year. Mr. Carr called the attention of his Committee to the projected combination of sulphate of ammonia manufacturers, whose circular was given in the "JOURNAL" for the 20th ult., and set forth the objects of the organization; and the Committee resolved to become members of the Association. Alderman Timmis, in moving the adoption of the minutes, alluded to the sulphate scheme, and said the Committee hoped by it to get better prices for the material, though it was not a project to regulate prices, but to create a demand. Mr. Bullough seconded the motion. Mr. Shores congratulated the Committee upon the immense increase in the quantity of gas delivered in April; showing an augmentation to the extent of 25 per cent. as compared with the corresponding period last year. He took it that this was a complete vindication of the policy of the Committee in reducing the charge for gas; and they would hope to see the same profits next year, notwithstanding that the price had been lowered, and money thus put into the pockets of consumers. Alderman Timmis expressed his obligations to Mr. Shores for his remarks; and the minutes were passed.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 1133).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	108—111	..	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	9¾—10¼	+¼	4 17 7
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	102—105	..	4 15 5
200,000	5	12 Nov.	6½	Bombay, Limited	6½—7½	..	4 6 8
40,000	5	,,	6½	Do. New, £4 paid	5—6	..	4 6 8
380 000	Stck.	26 Feb.	12	Brentford Consolidated	287—292	..	4 2 2
240,000	,,	,,	9	Do. New	223—228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	145—150	..	3 6 8
159,375	,,	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130—134	..	2 19 9
220,000	Stck.	25 Mar.	11½	Brighton & Hove Original	273—278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	197—202	..	4 4 2
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130—135	..	3 14 1
420,000	20	26 Mar.	11½	British	56—57	..	3 18 11
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23—25	..	4 12 0
71 000	10	,,	8½	Do. 7 p. c.	18—20	..	4 5 0
500,000	10	28 Apl.	6	Buenos Ayres (New) Limited	9½—10	..	6 0 0
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	101—103	..	5 16 6
150,000	20	26 Feb.	8½	Cagliari, Limited	30—32	+1	5 3 1
100,000	10	30 Sept.	6	Cape Town & District, Ltd	17—18	+1	3 6 8
50,000	50	3 May	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	348—353	+3	3 16 6
165,000	,,	,,	10½	Do. New do.	257—262	+2	4 0 1
165,000	,,	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150—155	..	2 18 0
800,000	Stck.	30 Dec.	13	Continental Union, Limited.	255—260	..	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	215—220	..	4 10 11
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.	317—322	..	4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255—260	..	4 4 7
535,000	Stck.	26 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	139—142	..	3 13 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	24½—25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	17½—18½	..	4 9 3
5,836,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	311—316	+2	4 0 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	112—117	+2½	3 8 5
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	310—315	..	3 3 6
30 000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155	..	3 4 6
63,000	,,	,,	7½	Do. G, 7½ p. c. do.	220—225	..	3 6 8
1.300,000	,,	,,	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	310—315	..	3 3 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182—187	..	3 4 2
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	137—142	..	2 16 4
294,850	,,	,,	4½	Do. 4½ p. c. do.	150—155	..	2 18 1
908,000	,,	,,	6	Do. 6 p. c. do.	207—212	..	2 16 7
70,000	10	13 May	6	Hongkong & China, Limited	13—14*	+1	4 5 10

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
3,800,000	Stck.	13 May	10	Imperial Continental	212—217*	..	4 12 2
376 400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk ,,	104—107	..	3 5 5
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	5¾—6¼	..	4 16 2
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	111—113	..	4 8 6
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107—109	..	4 2 7
541,920	20	12 Nov.	5	Monte Video, Limited	1¼—1⅝	−⅛	6 9 0
150.000	5	26 Nov.	8	Oriental, Limited	8½—9	..	4 8 11
135,000	5	,,	8	Do. New, £4 10s. paid	7½—8	..	4 10 0
15,000	5	,,	8	Do. do. 1879, £1 paid	1⅞—2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5—5½	..	6 7 3
420,000	100	3 May	6	People's Gas 1st Mtg. Bds.	101—106	..	5 13 1
500,000	100	1 Dec.	6	of Chicago 2nd Do.	104—109	..	5 10 1
250,000	10	30 Sept.	10	San Paulo, Limited	14—15	..	6 13 4
5,475.000	Stck.	26 Feb.	5¼	South Metrop., 4 p.c. Ord.	141—144	..	3 12 11
1,416,667	,,	—	3	Do. 3 p.c. Deb. Stk.	106—108	+2	2 15 7
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275—285	..	4 0 10
60,900	,,	,,	8½	Do. B	190—200	..	4 5 0
182,380	10	30 Dec.	10	Tuscan, Limited.	14—15	..	6 13 4
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	101—103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	30 Dec.	10½	Chelsea, Ordinary	327—332	+3	3 3 3
150,000	,,	,,	5	Do. 5 p. c. Pref.	175—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	158—162	..	2 15 6
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160—165	..	2 14 6
1,720,560	Stck.	9 Apl.	7	East London, Ordinary	221—225	+2½	3 2 9
654,740	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	164—169	..	2 13 4
330,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	107—109	+1	2 15 0
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	115—120	+3	3 2 6
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148—153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	340—345	..	3 9 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	212—217	..	3 4 6
1,043,800	100	30 Dec.	9½†	Lambeth, 10 p. c. max.	277—282	+3	3 9 1
406,200	100	,,	7½	Do. 7½ p. c. max.	220—225	..	3 6 8
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147—150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares	420—425	..	3 1 1
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152—155	..	2 11 7
902,300	Stck.	30 Dec.	6	S'thwk & V'xhall, Ordinary	155—160	..	3 15 0
126,500	100	,,	6	Do. Do. 7½ p. c. Max.	150—155	..	3 17 5
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175—180	..	2 15 7
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145—148	..	2 14 2
1,155,066	Stck.	11 Dec.	10	West Middlesex	310—315	..	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163—168	..	2 13 7

† Next Dividend will be at this rate. *Ex div.

Buxton Water Supply.—The Local Government Board have granted power to the Buxton District Council to borrow £10,000 for their water undertaking, in addition to the £45,000 already borrowed.

New Joint-Stock Companies.—The following joint-stock companies have lately been registered: Larkhall (Lanarkshire) Gas Company, with a capital of £6005, in £1 shares, to acquire the existing undertaking. Eveson Coal and Coke Company, Limited, with a capital of £50,000, in £1 shares, to acquire the business of Mr. G. J. Eveson, of Birmingham; Kent Coal Exploration Company, Limited, with a capital of £250,000, in £1 shares, to search for coal in Kent and elsewhere in the United Kingdom.

Wrotham Water Supply Scheme Vetoed.—The Local Government Board have sent a letter to the Wrotham District Council in respec of the inquiry made by one of their Inspectors as to the application of the Council to be invested with all the powers and duties given to rural authorities by the Public Health (Water) Act, 1878. The Board learn from the report of their Inspector that the object in asking for the powers is to compel owners of houses that are without a proper water supply to obtain one by sinking wells. It appears, however, that no single well could be sunk and water obtained at a cost within the limits imposed by the Act, which provides (by section 3) that the extent of the cost shall be a capital sum, the interest on which at the rate of 5 per cent. per annum would be 3d. a week – that is, a sum amounting to £13; and the Board are advised that the section must be construed as imposing the limit in respect of each house, considered separately, and not in conjunction with other houses. They are informed that this limit would be considerably exceeded in the Wrotham district; and the provisions of the Act could not therefore be carried out. The Council's application in this respect is consequently refused.

Cost of the Proposed Purchase of the Falmouth Gas and Water Works.—The bill of costs of the abortive proposal for the purchase of the Falmouth Gas and Water undertakings was presented at a meeting of the Corporation last Thursday. The total amount was £181. Mr. H. Liddicoat, in moving that the bills be paid, said that, though the amount was rather large, something had come out of the scheme in the form of a considerable reduction in the price of gas, and concessions from the Water Company. While the ratepayers declined to adopt the proposal to purchase the works, they must now see that it was beneficial to them, and would be so. Mr. J. Grose, who seconded the motion, thought the bill very moderate. The course adopted by the Corporation had resulted in £763 being saved every year to the gas consumers; and the Corporation effected an economy to the extent of £20 last quarter on the cost of street lighting as compared with the corresponding quarter of the past year. Mr. Phillips strongly opposed payment of the costs, which he said were incurred simply to satisfy one member of the Corporation. It was said that the price of gas had been reduced; but not one-tenth of the people of Falmouth burnt gas. On a vote being taken, five members voted for the payment of the accounts and two against, while nine abstained from voting; and Mr. Phillips threatened to move at the next meeting that the resolution be rescinded.

The Purchase of the Odessa Water-Works by the Municipality was completed last Thursday, when the money due to the late Company was handed over to the Liquidators for distribution among the shareholders.

Heanor Water Scheme.—The plans and estimates for a new water-supply scheme for Heanor have been before the District Council, who have decided to ask the Local Government Board for a loan of £18,000 for executing the work.

Lighting of Harwich.—At the quarterly meeting of the Harwich Town Council last Thursday, the Public Health Committee brought forward the public lighting question. The Harwich Gas Company objected to be bound down, as proposed, to supply 5 cubic feet of gas per hour; but they undertook to provide, with incandescent burners, a light of about 60-candle power in lieu of the 14-candle light which ordinary burners, consuming 5 cubic feet of gas per hour, would afford. The Committee recommended that a contract for three years be made in respect of the lamps where gas-mains are already laid, or where service-pipes from existing mains will supply the gas required for consumption, so that the Company will not be put to any material outlay; and the rest of the lighting will be continued with oil-lamps. It appearing, after some discussion, that the Company would be willing to put down the necessary mains for the public lighting of the whole town if the contract were for seven years, this offer, after several amendments had been brought forward and rejected, was put in the form of a substantive resolution, and adopted by seven votes to four.

Liverpool Gas and Electric Fittings Company, Limited.—At the annual general meeting of this Company last Wednesday, the Directors reported that the net profit for the year was £405, which, with £137 left after paying last year's dividend and bonus, made a sum of £542 to go to the credit of profit and loss. The Directors expressed regret that in consequence of the unsatisfactory result of the electrical portion of the business, and the large outlay on work in progress, they were unable to recommend the declaration of a dividend. The Chairman (Mr. J. Barkeley Smith), in moving the adoption of the report and accounts, said he must admit that they were not very satisfactory. For many years past, the Company had declared handsome dividends; but owing to losses on some electrical contracts, they were unable this year to recommend any payment. The sum of £3640 appeared in the accounts as expenditure on work in progress; and this was greatly in excess of the amount last year. Upon this expenditure they hoped to make some profit; but after the disappointments they had had, they were not prepared to calculate upon it. The electrical business involved a much larger outlay than had been reckoned upon; and, if it was desired to continue it, it was clear that the capital of the Company would have to be increased. The Directors were unable to recommend the shareholders to increase it; and they had therefore come to the conclusion that the better course was to get rid of the electrical business, and fall back upon gas-fittings. There was an increased demand for gas cooking-stoves, and the Directors hoped to carry on the gas-fittings business at a fair and reasonable profit. Mr. Lister seconded the motion; and it was carried.

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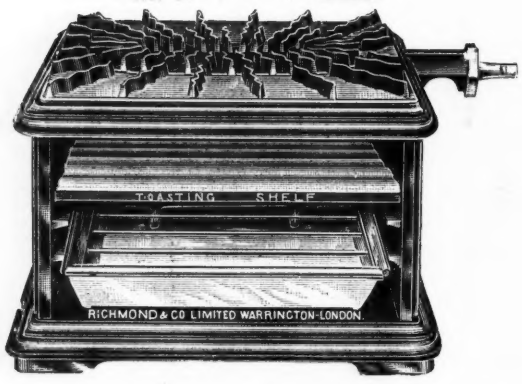

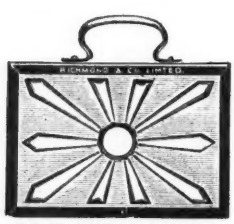

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The Purchase of the Driffield Gas-Works.—The Driffield District Council yesterday week decided to enter into an arrangement with the Yorkshire Penny Bank for a loan of £22,500 for twenty years at 3 per cent. interest, subject to the option of either party to terminate the loan on six months' notice after the expiration of ten years. The amount of the loan is the price fixed by the valuers to be paid to the Gas Company for their undertaking. A further loan of £1500, to be obtained on the same terms, is required to pay the costs of the Provisional Order and incidental expenses.

Gas and Water Works Purchase Question at Wimborne.—A poll of the inhabitants of Wimborne has been taken as to the desirability of purchasing the works of the Gas and Water Companies. Three resolutions were placed before the ratepayers. The first was that it was expedient for the District Council to purchase the undertaking of the Gas Company; the second was in favour of a similar step with regard to the Water Company; and the third was a request to the Companies to sell their undertakings and businesses, and in the event of the Gas Company refusing to sell or neglecting to reply, the Council be requested to give notice of opposition to the Company's Bill in Parliament and to insist on a purchase clause being inserted. The poll showed considerable majorities against all three resolutions. The total number of votes in favour were: First resolution, 112; second, 67; third, 106. Against: First resolution, 412; second, 401; third, 404—the totals being 285, compared with 1217.

A Year's Profit at the Bolton Corporation Gas-Works.—The return as to the working of the Bolton Corporation Gas Department for the past financial year shows that the income amounted to £149,367; being £6605 in excess of the receipts the previous year. The incomes for the month of March in the two years are somewhat remarkable. In March, 1896, the receipts were only £6779; while in the corresponding month of this year they aggregated £12,765, or nearly double. The sales of gas were £8000, against £3000; the receipts for coke rose £300, and the sales of sulphate of ammonia increased by upwards of £800. At the last monthly meeting of the Town Council, Mr. Melling suggested that, in view of the enormous increase shown, there should be a reduction in the price of gas. Alderman Miles, the Chairman of the Gas Committee, said the increased income was not by any means all profit; it was simply a case of more money coming in for a variety of reasons.

The Walsall Corporation have decided to purchase from Messrs. Clapham Bros., Limited, one of their "Eclipse" washer-scrubbers, to pass a million cubic feet of gas per twenty-four hours.

Messrs. Richmond and Co., Limited, have been holding exhibitions at Leeds and Sowerby Bridge. At the first-named place, Mrs. J. J. Middleton delivered cookery lectures, with practical demonstrations.

Messrs. John Wright and Co., Limited, held a successful exhibition at Deal from the 3rd to the 7th inst., under the auspices of the Deal and Walmer Gas Company; Miss Ada Ball giving cookery demonstrations with one of the firm's "Eureka" stoves.

Messrs. W. Parkinson and Co. last week successfully held the following gas exhibitions: In the Town Hall, Berkhamstead, from Monday to Friday, with practical lessons on cookery by Miss Edith Sanderson; and in the Assembly Rooms, Handsworth, from Monday to Friday, with cookery lessons by Mrs. E. A. Springthorpe.

The West Stanley Gas Company, having decided to erect a new retort-house to contain eight beds of retorts on the regenerative principle, the whole of the contract has been placed in the hands of Messrs. R. Dempster and Sons, Limited, of Elland, who will also put up new settings of eights, on Mr. W. R. Chester's regenerative system, for the Otley Gas Company, for whom the firm have in hand a foul main and tower scrubber.

At a gas and electric exhibition held at St. George's Hall, Burton-on-Trent, from Monday to Friday last week, under the supervision of Mr. F. L. Ramsden, the Manager of the Gas and Electric Light Department of the Burton Corporation, the gas exhibits were furnished by the Davis Gas-Stove Company, Limited, Messrs. John Wright and Co., Limited, and Messrs. Fletcher, Russell, and Co., Limited. Mrs. Marshall gave cookery lectures twice each day.

Messrs. Fletcher, Russell, and Co. held an exhibition at Maidstone last week, in conjunction with the Gas Company. At the opening, the audience were briefly addressed by the Manager of the latter (Mr. H. Smythe), who stated that, in the past ten years, the number of consumers had increased from 2400 to 4335; and the amount of gas used, from 150 million to 225 million cubic feet. The number of gas-stoves in use had also risen from 400 to 2000 in the same period. Miss Rose Brown had charge of the cookery demonstrations, which were largely patronized.

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They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

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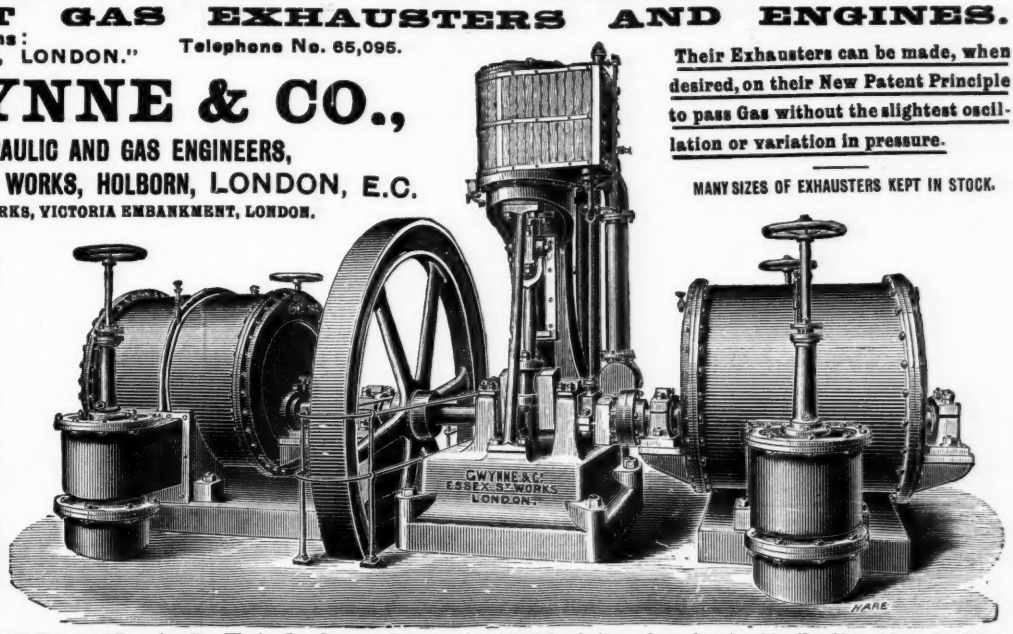

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O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director, Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. in use in most Continental Gas-Works, and in more than 300 British Gas-Works.

ANDREW STEPHENSON, 182, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.

Telegrams: "Volcanism, London."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

[For Illustrated Advertisement, see May 4, p. 1020.]

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.

120 and 121, NEWGATE STREET, LONDON, E.C.

Telegrams: "BOGORE, LONDON."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE BOLTON. Special Attention to Repairs.

Before placing Orders, please write for Estimate.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application.

70, CHANCERY LANE, LONDON, W.C.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND Co., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND Co., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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BROTHERTON AND Co., Chemical Manufacturers.
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BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 1026, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

THE Engineer of a large Gas-Works, with exceptional advantages, has a vacancy for a PUPIL.
Apply, by letter, to No. 2833, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COLLIERIES, ENGINEERS, AND GAS-WORKS.

A FIRM of Leeds Engineers, of long standing, with Central Offices, are open to act as SOLE AGENTS in Yorkshire and Lancashire, for the Sale of Goods to the above. Would undertake to open and manage Branch Warehouse if required.
Address No. 2837, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CHEPSTOW WATER COMPANY.

THE Company require a Manager of the Works and COLLECTOR of Water-Rates.
Salary and Commission, for combined Offices, about £100 a year, with House, Rent free.
Applications, with *copies* of recent Testimonials, must be sent to R. E. W. BERRINGTON, Civil Engineer, WOLVERHAMPTON, on or before May 31, 1897.

LEIGH URBAN DISTRICT COUNCIL.

APPOINTMENT OF GAS NGINEER AND MANAGER.

THE Leigh Urban District Council invite APPLICATIONS from qualified persons for the appointment of GAS ENGINEER and MANAGER of their Works.
Candidates must not be less than 30, nor more than 45 years of age.
The Salary will be £300 per annum, payable quarterly; and the person appointed will be required to devote the whole of his time to the Duties of the office, and the engagement will be determinable on three calendar months' notice from any date.
Printed forms, upon which application must be made, can be obtained at my Office, or will be sent upon receipt of a stamped addressed foolscap envelope.
Applications, accompanied by *copies* (which will not be returned) of not more than three Testimonials of recent date, must reach me not later than May 29, 1897, endorsed "Gas Engineer and Manager."
By order,
GEO. DICKINSON,
Clerk to the Council.
Town Hall, Leigh, Lancs.,
May 5, 1897.

WANTED, a 50,000 Feet per hour second-hand STATION METER, in good working condition, and by first-class Maker.
Price and full Particulars to be sent to W. TITLEY, Gas Offices, GUILDFORD.

WANTED, to purchase Gas Carbon delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating Price per ton and quantity, No. 2772, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

ALEX. P. KER, C.E., Consulting Gas Engineer, Hunton Road, Grave'ly Hill, Birmingham, 25 Years Assistant Engineer and Manager of Works to the Corporation of Birmingham and their predecessors, MAY BE CONSULTED on all matters connected with GAS ENGINEERING, including Valuations, Alterations, Additions and Extensions, &c. REPORTS upon EXISTING WORKS and IN PROGRESS. EXAMINATIONS OF GAS for ILLUMINATING POWER and IMPURITIES conducted. Plans, Specifications, and Estimates prepared.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

WANTED, to Rent or Purchase, a small TAR DISTILLERY.
Address No. 2847, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Six 15-inch Circular RETORT MOUTHPIECES and LIDS.
Apply to J. ESCOTT, Gas-Works, LLANTRISANT.

STORAGE Tanks for Tar and Liquor. Several Wrought and Cast Iron ones up to 275,000 gallons capacity FOR DISPOSAL cheap.
J. FIRTH BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR SALE—A Station Meter complete, in thorough working order. Recently overhauled and certified correct by Messrs. Braddock. Capacity, 50,000 feet per hour.
Apply to JOHN H. DARBY, Brymbo, near WREXHAM.

FOR SALE—A Station Meter, with 6-inch Connections. Made by Milne, of Edinburgh. Capacity 6000 cubic feet per hour. In good working order; being replaced by a larger one. May be seen at the Irvine Gas-Works.
ALEX. WALKER,
Manager.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

UXBRIDGE AND HILLINGDON GAS CONSUMERS' COMPANY.

GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 3500 Tons of GAS COAL, deliveries of which are to commence the first week of July, 1897, and finish the last week of May, 1898.
Tenders to be made out for 1000 Tons of best South Yorkshire unscreened Silkstone Gas Coal, delivered in Trucks (free) at Uxbridge Railway Station, G.W.R., each Ton to contain 20 cwt., and 2500 Tons of the best description of unscreened Gas Coal from the Durham Coal-Fields delivered by Barge (free) alongside the Company's Works, Grand Junction Canal.
Tenders are to state the Names of the Pits from which the above description of Coal will be supplied, the same to be fresh wrought, and free from Slate and other Impurities, and to the entire satisfaction of the Company's Engineer.
Deliveries to be according to the requirements of the Company.
Tenders to be received on or before the 3rd day of June next, addressed to the Chairman, Gas Company's Office, Uxbridge, Middlesex, and endorsed "Tender for Coal."
A Form of Tender will be sent on application.
W. & W. M. GARDINER,
Secretaries.
Uxbridge, Middlesex,
May 15, 1897.

BLUE PRINTS of all kinds in any weather. Drawings and Tracings promptly executed.
J. L. FEATHERSTONE, 21, Old Queen Street, WESTMINSTER, S.W.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND,
NEWTON GRANGE, NEWBATTLE, DALKEITH, }

TO GAS AND WATER OFFICIALS.

SPECIAL and Favourable Terms for CYCLES are offered. The very best "up-to-date" Cycle at a reasonable Cost. "Dunlop" Tyres, Weldless Tube throughout, "Westwood" Rims, "Brook's" Saddle, "Perry's" or "Renold's" Chain, &c. The whole combining to make as fine a Machine as is possible to be made. Satisfaction guaranteed. Send at once for Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

CITY OF CARLISLE.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for the COAL and CANNEL required at their Works during One Year from the 1st of July next.
Tenders to be delivered to the undersigned not later than May 31, 1897.
Forms of Tender and other Particulars on application.
C. B. NEWTON,
Engineer and General Manager.
Gas-Works, Carlisle,
May 15, 1897.

CITY OF CARLISLE.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for the surplus TAR produced at their Works for a period of One Year from the 1st of July next.
Tenders to be delivered to the undersigned not later than May 31, 1897.
Further Particulars can be obtained on application.
C. B. NEWTON,
Engineer and General Manager.
Gas-Works, Carlisle,
May 15, 1897.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee are pre pared to receive TENDERS for the supply of about 111,000 Tons of COAL and CANNEL required by them during the Year ending the 30th of June, 1898.
Specifications and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom tenders are to be sent on or before Tuesday, the 25th inst.
A. NICHOLSON,
Town Clerk.
May 7, 1897.

PONTYPRIDD URBAN DISTRICT COUNCIL.

THE Gas Committee are prepared to receive TENDERS for the supply and erection of a COKE-ELEVATOR and STEAM-ENGINE at the Gas-Works, Treforest, near Pontypridd.
The Specification and Drawings may be seen at the Offices of Messrs. Thomas Newbigging and Son, Engineers, 5, Norfolk Street, Manchester.
Sealed tenders, endorsed "Coke-Conveyor, Contract No. 14," to be sent so as to reach me not later than noon, on Saturday, June 5.
The Committee do not bind themselves to accept the lowest or any tender.
HENRY LL. GROVER,
Clerk.
Urban District Council Offices,
Pontypridd, May 15, 1897.

URBAN DISTRICT COUNCIL OF BUXTON.

TENDERS FOR TAR AND LIQUOR.

THE Buxton District Council invite TENDERS for the purchase of the surplus TAR and LIQUOR produced at their Works in Ashwood Dale, for One, Two, or Three Years, commencing from the 30th of June next.
Further Particulars and Forms of Tender to be obtained of Mr. G. Smedley, Gas Office, Buxton.
Tenders, endorsed "Tender for Tar and Liquor," to be addressed to the Chairman of the Gas Committee, and delivered not later than Twelve Noon on the 29th inst.
The Council do not bind themselves to accept the highest or any tender.
By order,
JOSIAH TAYLOR,
Clerk.
Town Hall, Buxton,
May 13, 1897.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Prescot Gas Company are prepared to receive TENDERS for the surplus TAR produced at their Works for a term ending May 31, 1898.

Sealed tenders, endorsed "Tender for Tar," to be sent to the undersigned on or before the 22nd of May next.

The Directors do not bind themselves to accept the highest or any tender.

For further Particulars apply to

JOHN E. HALL,
Manager and Secretary.

Gas-Works, Prescot.

THE Directors of the Skipton Gas Company are prepared to receive TENDERS for the purchase and removal of the surplus TAR and AMMONIACAL LIQUOR produced at their Works during Twelve Months ending June 30, 1898.

Particulars may be obtained from the undersigned, to whom sealed and endorsed tenders may be sent not later than June 8 next.

The Directors do not bind themselves to accept the highest or any tender.

J. HAIGH,
Secretary.

Skipton, May 13, 1897.

COAL CONTRACT.

THE Directors of the Hexham Gas Company are prepared to receive TENDERS for the supply of about 2800 Tons of unscreened GAS COAL, delivered at Hexham Station as directed, during the Year ending June 30, 1898.

Tenders, with Analysis of Coal and Name of Pit at which it is raised, to be forwarded to the undersigned not later than the 1st of June.

HERBERT LEES,
Secretary and Manager.

Gas-Works, Hexham,
May 13, 1897.

THE Corporation of Blackpool are prepared to receive TENDERS for the supply of COAL and CANNEL for the next Twelve Months, commencing June 1.

For Conditions and Forms of Tender, apply to the undersigned.

Tenders, endorsed outside, must be sent in, addressed to the Chairman of the Gas Committee, by the 22nd day of May.

(Signed) JOHN CHEW,
Gas Engineer.

Corporation Gas-Works,
Blackpool, May 11, 1897.

THE Accrington District Gas and Water Board invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR which may be produced at their Accrington and Great Harwood Works during the Year from the 30th of June to the 30th of June, 1898.

Coal Carbonized at Accrington, 16,400 Tons.
Do. Great Harwood, 11,200 "

Tenders, endorsed, to be sent to A. H. Aitken, Esq., Clerk to the Board, on or before Thursday, the 3rd of June.

Particulars can be obtained from the undersigned.

CHAS. HARRISON,
General Manager.

CITY OF RIPON.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of about 3000 Tons of GAS COAL for a period of Twelve Months, commencing the 1st of July next.

For further Particulars, apply to Mr. F. Shepherd, Gas Manager, Ripon.

Sealed tenders, endorsed "Tender for Gas Coal," to be sent to me on or before the 2nd of June next.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
M. KIRKLEY,
Town Clerk.

Ripon, May 8, 1897.

TENDERS FOR TAR AND LIQUOR.

THE Aberdare Gas Company invite TENDERS for the purchase of their surplus TAR, and the AMMONIACAL LIQUOR produced from about 5000 Tons of Coal per annum. The strength of the Liquor to be tested by Twaddel's Hydrometer (Temperature 60°); and the tender to name the price per ton of 4° rising by 1° up to 7°, delivered in Purchaser's Railway Tanks at the Gas-Works.

Tenders may be sent in for either Tar or Liquor on or before the 6th of June next (the lowest or any tender not necessarily accepted), to

EVAN JONES,
Secretary and General Manager.

Gas-Works, Aberdare,
May 12, 1897.

TENDERS FOR GAS COAL.

THE Directors of the Sunderland Gas Company are prepared to receive TENDERS for GAS COAL for One, Two, or Three Years (in lots of 5000 Tons and upwards), to be delivered by Rail on the Company's Sidings at Hendon or Ayre's Quay Gas-Works, from July 1, 1897, in such Monthly proportions, during the continuance of the Contract, as the make of Gas may render necessary.

The Coal to be Clean, Dry, and Fresh Worked.

Tenders, endorsed "Tender for Gas Coal," specifying the description of Coal, the name of the Pit and the particular Seam from which the Coal is to be supplied, to be left at the Offices of the Company, Borough Road, Sunderland, on or before Ten a.m., on Tuesday, the 25th of May.

Short weight or inferior quality to be allowed for.

The Company do not bind themselves to accept the lowest or other Tender until after a satisfactory trial of the Coal to which such Tender may relate shall have been made.

J. H. COX,
Secretary and Manager.

Sunderland, May 12, 1897.

RHYL URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Gas Committee of the Rhyl Urban District Council invite TENDERS for the supply of 3000 Tons of best screened GAS COAL for One Year, from the 1st of July, 1897, to be delivered at Rhyl Station, in such monthly quantities as may be required.

Further Information and Forms of Tender to be obtained from Mr. Leonard G. Hall, Gas Engineer and Manager.

Sealed tenders, endorsed "Tender for Coal," to be addressed to the Chairman of the Gas Committee, Clwyd Street Offices, Rhyl, on or before the 26th of May, 1897.

The Committee do not bind themselves to accept the lowest tender.

ARTHUR ROWLANDS,
Clerk to the Council.

Council Office, Rhyl,
May 13, 1897.

GUILDFORD GASLIGHT AND COKE COMPANY.

TO COAL MERCHANTS.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 5000 to 7000 Tons of YORKSHIRE GAS COAL, to be delivered free at Guildford Station during the period of One Year from July 1, 1897, to June 30, 1898, in such quantities and at such times as required.

The Directors reserve the right to accept the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any tender.

Tenders to state the name of the Coal offered, to be endorsed "Tenders for Coal" and to be sent to Mark Smallpeice, Esq., Chairman of the Gas Company, Guildford, on or before Wednesday, May 19, 1897.

By order,
WILLIAM TITLEY,
Secretary.

Gas Office, Guildford,
May 4, 1897.

TO COAL MERCHANTS, SHIP OWNERS, AND OTHERS.

THE Directors of the Torquay Gas Company are prepared to receive TENDERS for the supply for One, Two, or Three Years of about 14,000 Tons per year (or such other quantity as may be agreed on) of best approved GAS COAL.

Tenders to state the price of the Coal and the freight to Dartmouth or Torquay, separately and together, and also for delivery into the Company's Works adjoining the Great Western Railway, free of all charges.

Payment by cash for freight on delivery and by three months' Bills for the Coal.

Further Particulars to be obtained from Mr. Beynon, the Manager of the Company, Hollacombe, Paignton; and tenders to be sent to the undersigned on or before the 22nd inst.

Forms of Tender to be obtained from the Manager, on payment of a fee of 10s. 6d., returnable on receipt of a *bond-fide* tender.

JOHN KITSON,
Secretary.

Torquay, May 4, 1897.

MANSFIELD CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL & CANNEL.
TENDERS FOR TAR & AMMONIACAL LIQUOR.

COAL.

THE Gas Committee are prepared to receive TENDERS for 1500 Tons of CANNEL and 6500 Tons of best screened GAS COAL, delivered at Mansfield Station, for One Year, from the 1st of June, 1897, to the 31st of May, 1898.

TAR AND LIQUOR.

TENDERS for TAR and LIQUOR made during the Year, from the 1st of July, 1897, to the 30th of June, 1898. Tenders for Liquor to be made either at a fixed price per Ton or on the Sliding-Scale regulated by the price of Sulphate.

Tenders, endorsed, to be sent to J. Harrop White, Esq., Deputy Town Clerk, Mansfield, on or before the 26th of May, 1897.

Particulars and all other Information from the undersigned.

No special Form of Tender provided.

The Committee do not bind themselves to accept the lowest or any tender.

ARTHUR GRAHAM,
Engineer and Manager.

Gas-Works, Mansfield,
May 4, 1897.

GLOUCESTER GASLIGHT COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of about 24,000 Tons of GAS COAL for One Year from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price f.o.b., and also the price delivered at the Gas Company's Wharf on the Gloucester and Berkeley Canal.

Further Particulars and Forms of Tender may be obtained of the Company's Engineer, Mr. R. Morland.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, Eastgate Street, Gloucester, and delivered not later than the 29th day of May inst.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
May 6, 1897.

THE Directors of the Skibbereen Gas-light and Coke Company, Limited, invite TENDERS for 400 to 500 Tons of the best GAS COAL, delivered in the Ilen River, at the usual place of discharge.

Tenders, with the Analysis of the Coal, will be received by them up to the 1st of June next.

Skibbereen Gas Company,
May 8, 1897.

THE Corporation of Middleton are prepared to receive TENDERS for RAISING the ROOF of the RETORT-HOUSE at their Gas-Works.

Plans, &c., may be seen, and Specifications obtained, on application to Mr. T. Duxbury, Gas Manager, after Wednesday, the 5th of May, between the hours of 9.30 and 11.30 a.m.

Tenders, endorsed "Tender for Raising Roof," and addressed to the Chairman of the Gas Committee, to be delivered at my Office not later than Wednesday, the 19th of May, 1897.

The Corporation do not bind themselves to accept the lowest or any tender.

FREDERICK ENTWISTLE,
Town Clerk.

Town Clerk's Office, Middleton,
April 29, 1897.

URBAN DISTRICT COUNCIL OF DUKINFIELD

TENDERS FOR GAS COAL.

THE Gas Committee require Tenders for 7000 Tons of GAS COAL, to be delivered Road, Rail, or Canal, commencing on the 1st of March next, and concluding the 30th of June, 1898. None but fresh-got screened best quality GAS COAL, free from faults, need be offered; and no Testimonials or Analyses are required.

No tender will be considered which may be received after Twelve noon on Monday, the 31st of May.

Sealed envelopes, endorsed "Coal," to be directed to the Chairman of the Committee, Mr. Councillor Stafford, Gas Offices, Charles Street, Dukinfield.

Tender Forms and further Particulars on application to

HARRISON VEEVERS, C.E.,
Engineer and Secretary.

Dukinfield, April 27, 1897.

URBAN DISTRICT COUNCIL OF HAVERHILL.

TENDERS FOR COAL.

THE Council invite Tenders for the supply of 1500 Tons of the best screened SILKSTONE GAS COAL, to be delivered free at Haverhill Station during the period of One Year from the 15th day of June next.

Delivery will be taken from time to time as the Manager shall require the same.

The Council reserve the right to divide the Contract into two of 750 Tons each.

The person whose tender is accepted will be required to enter into the usual Contract for due performance thereof.

Tenders, in sealed envelopes, endorsed "Tender for Coal," should be addressed and sent to me the undersigned not later than the 1st day of June next.

By order,
SIDNEY H. GRAHAM,
Clerk to the Council.

Haverhill, May 14, 1897.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 45,000 Tons of best well-screened large GAS COAL, to be delivered between July, 1897, and the 30th of June, 1898, in monthly quantities, in accordance with the Specification.

Parties tendering may do so for the whole quantity, or for quantities from 5000 Tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to the Engineer and Manager, Mr. H. Morley, M.Inst.C.E.

Sealed tenders to be sent to the undersigned not later than Ten a.m., Tuesday, the 25th day of May next, addressed to the Chairman of the Company, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order,
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
April 24, 1897.

EXMOUTH GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Exmouth Gas Company invite TENDERS for 6500 Tons or 3500 Tons (at their option for One or Two Years) of clean, unscreened (through and through) first-class NEWCASTLE, DURHAM, or ALDWARKE MAIN GAS COAL, to be shipped in such quantities (by Sailing Vessels only), and at such times as may be required, commencing from the 1st of August next.

Tenders to be accompanied by Working Analysis; and Prices may be quoted c.i.f. or f.o.b. at Exmouth Docks.

Sealed tenders to be sent to the undersigned, addressed to the Chairman of the Company, and endorsed "Tender for Coal," not later than Saturday morning, the 29th day of May next.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender (no special Form of Tender issued).

By order,
JAMES T. FOSTER,
Secretary and Manager.

Gas-Works, Exmouth,
May 7, 1897.

HAWORTH URBAN DISTRICT COUNCIL.

TENDERS are invited by the above Council for the supply of 2000 Tons of unscreened GAS COAL, to be delivered (in such quantities as the Council may determine) on Rails at Haworth Railway Station within the ensuing Twelve Months.

Sealed tenders to be forwarded to me the undersigned, marked "Coal Tender," not later than the 27th inst.

WM. ROBERTSHAW,
Clerk.

Burlington Chambers, Keighley,
May 6, 1897.

THE Directors of the Farnworth and Kearsley Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIACAL LIQUOR produced at their Works, together or separately, for One Year.

Sealed tenders, addressed to the Chairman, J. W. Watkinson, Esq., to be delivered on or before Monday, May 24.

Forms of Tender and any further Information required may be obtained from the undersigned.

T. L. SHEPPARD,
Manager.

MOSSLEY CORPORATION GAS-WORKS.

THE Gas Committee are prepared to receive TENDERS for the surplus TAR produced at their Works between the 25th of March last and the 25th of March, 1898.

Particulars and Form of Tender may be had on application to the Manager (R. Merrell), at the Works.

Sealed and endorsed tenders must be delivered to the undersigned not later than the 5th of June next.

The Committee do not bind themselves to accept the highest or any tender.

JOSEPH HYDE,
Town Clerk.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Leek Urban District Council invite TENDERS for the supply of best screened GAS COAL and NUTS for One Year from the 1st of July next, to be delivered at the Leek Station, on the North Staffordshire Railway, at such times and in such quantities as may be required.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, Leek, by Four o'clock in the afternoon of Monday, the 31st of May inst.

The lowest or any tender will not necessarily be accepted.

By order,
C. HENSHAW,
Clerk.

Town Hall, Leek,
May 11, 1897.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR TAR.

THE Gas Committee of the Corporation of Lincoln are prepared to receive TENDERS for the purchase of the surplus TAR (about 800 Tons) produced at their Works during the period of One Year, commencing on the 1st of July, 1897.

Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Residuals," must be delivered at the Gas Offices, Lincoln, on or before the 22nd inst.

The Committee do not bind themselves to accept the highest or any tender.

Other Particulars may be obtained of the undersigned.

JNO. CARTER,
Manager.

Gas-Works, Lincoln,
May 8, 1897.

COUNTY BOROUGH OF HUDDERSFIELD.

TENDERS FOR GAS COAL AND NUTS.

THE Gas Committee are prepared to receive TENDERS, from Colliery Proprietors only, for the supply and delivery of from 50,000 to 60,000 Tons of UNSCREENED GAS COAL and SCREENED NUTS for a period of Twelve Months, commencing the 30th of September next.

Full Particulars and Form of Tender may be obtained on application to the Engineer and Manager, Mr. E. A. Harman, Gas-Works, Huddersfield.

Sealed tenders, endorsed "Tender for Gas Coal," must be delivered free of charge, addressed in the handwriting of the tenderer or his agent, to the Town Clerk, Town Hall, Huddersfield, and delivered not later than Tuesday, the 25th day of May, 1897.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
F. C. LLOYD,
Town Clerk.

Town Hall, Huddersfield, May 7, 1897.

COUNTY BOROUGH OF HUDDERSFIELD.

TO TAR DISTILLERS, &c.

THE Gas Committee of the Corporation are prepared to receive TENDERS for the surplus TAR produced at their Works for Twelve Months, from the 1st of July, 1897, or such other terms as may be agreed upon.

Particulars respecting quantity, &c., may be had on application to the Gas Engineer and Manager (Mr. E. A. Harman, Gas-Works, Huddersfield).

Sealed tenders, endorsed "Tender for Tar," must be delivered, free of charge, addressed in the handwriting of the tenderer or his agent, to the Town Clerk, Town Hall, Huddersfield, and delivered not later than Tuesday, the 25th day of May, 1897.

The Corporation do not bind themselves to accept the highest or any tender.

By order,
F. C. LLOYD,
Town Clerk.

Town Hall, Huddersfield,
May 13, 1897.

THE Widnes Corporation invite Tenders for the supply of about 20,000 Tons of GAS COAL (Slack, "Through and Through," or Screened Coal), for the period ending June 30, 1898, to be delivered at the Gas-Works, Widnes.

Conditions and Forms of Tender may be obtained from Mr. I. Carr, Assoc.M.Inst.C.E., Gas Engineer, Widnes.

Tenders, endorsed "Gas Coal," to be delivered to the undersigned on or before the 31st of May inst.

The lowest or any tender not necessarily accepted.

H. S. OPPENHEIM,
Town Clerk.

Town Hall, Widnes,
May 15, 1897.

CANTERBURY GAS AND WATER COMPANY.

TENDERS FOR GAS COAL.

TENDERS are invited for the supply of best NEWCASTLE GAS COAL for One, Two, or Three Years, at the Purchasers' option, commencing on the 1st of June next.

Forms of Tender, containing full Particulars as to the quantities required and Conditions of the Contract, may be obtained on application to the undersigned.

Sealed tenders, endorsed "Coal," to be delivered at the Company's Offices, on or before Saturday, the 22nd of May next.

JAMES BURCH,
Secretary.

39, Castle Street, Canterbury,
April 23, 1897.

PAIGNTON GAS COMPANY.

TENDERS FOR GAS COAL.

THE Directors of the Paignton Gas Company are prepared to receive TENDERS for the supply for One, Two, or Three Years of about 3700 Tons per Year of best quality GAS COAL, in such monthly quantities as may be required by the Company.

Tenders to state Price of Coal delivered at Paignton Station, Great Western Railway, free of all charges.

The Directors do not bind themselves to accept the lowest or any tender.

Further Particulars to be obtained from the Company's Manager.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be sent on or before the 30th inst., addressed to the undersigned, Gas Offices, 5, Victoria Street, Paignton.

F. W. PUDDICOMBE,
Secretary.

Paignton, May 15, 1897.

BELPER GAS AND COKE COMPANY.

TENDERS FOR COAL AND CANNEL.

THE Directors are prepared to receive TENDERS for the supply at their Works, situate near the Railway Station, Belper, of 3000 Tons more or less of GAS COAL (part in the Gas Company's own Waggons); also, about 400 Tons more or less of CANNEL COAL, to be delivered at such times, and in such quantities, as the Directors or their authorized servants shall from time to time order.

Sealed tenders, stating price per ton of 21 cwt., and Information as to the quality and quantity of Gas the Coal is estimated to produce, also, as to where the same is now in use, to be sent to the undersigned, on or before Friday, the 4th of June.

The Directors do not bind themselves to accept the lowest or any tender, nor to take the whole of the above quantities of Coal or Cannel.

By order,
JOSEPH PYM,
Managing-Director.

Belper, May 12, 1897.

BY EDWIN FOX AND BOUSFIELD,
AT THE AUCTION MART, ON
TUESDAY, JUNE 1, AT TWO, IN LOTS OF
20 SHARES EACH,
By order of the Directors.

CLACTON-ON-SEA GAS & WATER COMPANY, LTD.

ISSUE of £10,000 New Capital, in 2000 £5 Shares, ranking for Standard Dividend of 7 per cent., in the above successful and flourishing Undertaking, which supplies the well-known and rising Town of Clacton-on-Sea.

The Company was established in 1875, and the total Authorized Capital is £50,000; this issue forming part. The amount called and paid up is £20,000, in £5 10 per cent. Shares, which received last year a Dividend of 4½ per cent., making a Dividend on these Shares equal to a rate of £3 3s. per cent.

Particulars at Messrs. EDWIN FOX AND BOUSFIELDS' OFFICES, 99, Gresham Street, BANK, E.C.; and of the Solicitors to the Company, Messrs. YOUNG AND SONS, 29, MARK LANE, E.C.

SALE OF GAS SHARES.

THE Hastings and St. Leonards Gas Company, pursuant to their Act of 1883, invite TENDERS for 250 SHARES of £20 each, in 50 Lots of Five Shares each, to be sent to Messrs. W. B. Young and A. E. Young, Bank Buildings, Hastings, the Joint Secretaries of the Company, on or before the 2nd day of June next.

The whole amount payable, including premium, will have to be paid to the Company's account at the London and County Bank, Hastings Branch, on or before the 30th day of June next; and the new Issue will be entitled to its first Dividend from that date to the 31st of December, 1897, after the declaration of Dividend in March next.

The Directors intend to fix a Reserve Price for the Shares.

Tenders may be made for one or more Lots; and Forms of Tender and any further Particulars may be had of the Secretaries.

W. B. YOUNG,
A. E. YOUNG,
Joint Secretaries to the Hastings and St. Leonards Gas Company.

Bank Buildings, Hastings.

ILFORD GAS SHARES.

SOUND INVESTMENT.

By order of the Board of Directors of the Ilford Gaslight and Coke Company, Limited,

MR. ASHMOLE will Sell by Auction, at the Angel Hotel, Ilford, on Thursday, June 3, 1897, at Five for Six o'clock p.m., 800 "B" SHARES of the nominal Value of £5 each in the above old-established and flourishing Company.

Particulars and Conditions of Sale may be obtained of the SECRETARY of the Company, or of WM. ASHMOLE, F.A.I., Auctioneer, Surveyor, and Estate Agent, Broadway, ILFORD.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

SALE OF 500 SHARES.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, London, E.C., on Wednesday, May 26, at Two o'clock, in Lots, 500 £10 "C" SHARES (fully-paid) in the HARROW AND STANMORE GAS COMPANY, ranking for a Standard Dividend of 7 per cent.; the last Dividend on the same class of Shares having been at the rate of 5½ per cent. per annum, and offering an Investment of the soundest character.

Particulars of the SECRETARY of the COMPANY, at the Gas-Works, HARROW, and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.
500 SHARES IN THE
SOUTHEND WATER-WORKS COMPANY.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, E.C., on Wednesday, May 26, at Two o'clock, in lots, 500 £10 SHARES (to be issued as fully paid) in the above Undertaking, ranking for a Maximum Dividend of 7 per cent.; the last Dividend on the same class of Shares having been at the rate of 5 per cent. per annum.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of Executors and others.
GAS AND WATER DEBENTURE AND ORDINARY STOCKS AND SHARES IN THE
Brentford Gas Company.
Tonbridge Gas Company.
Wandsworth and Putney Gas Company.
Barnet District Gas and Water Company.
Hornsey Gas Company.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, London, E.C., on Wednesday, the 26th of May, at Two o'clock, in lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

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Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.
LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . .	11,205 Cubic Feet.
Illuminating Power,	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. Per Ton.
Sulphur	A little over 1 Per Cent.
Ash	Under 1 Per Cent.
Tar	163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS
PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.
RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . .	10,500 Cubic Feet.
Illuminating Power	17 Stand. Sperm Candl.
Coke (of excellent quality)	13½ Cwt. Per Ton.
Sulphur	1·13 Per Cent
Ash	1·34 Per Cent.
Tar	180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

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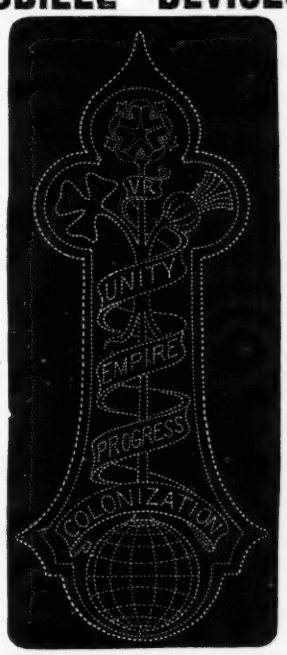

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Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

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Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

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Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

Analysis—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to
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WHITE GLAZED AND SALT GLAZED BRICKS, BUFF FACING BRICKS, &c.
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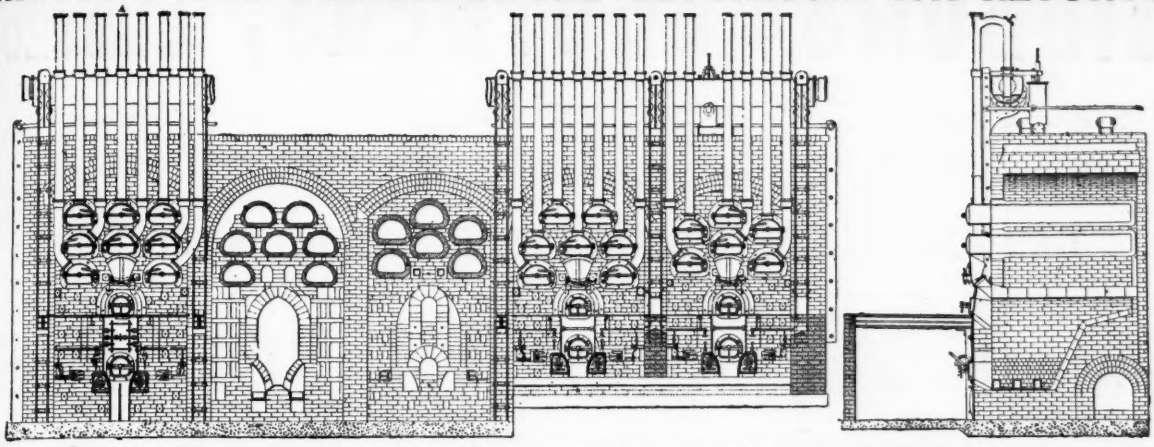

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THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, *5*, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

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Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.
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ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

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Manufacture & supply best quality of
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DESIGNS AND ESTIMATES ON APPLICATION.

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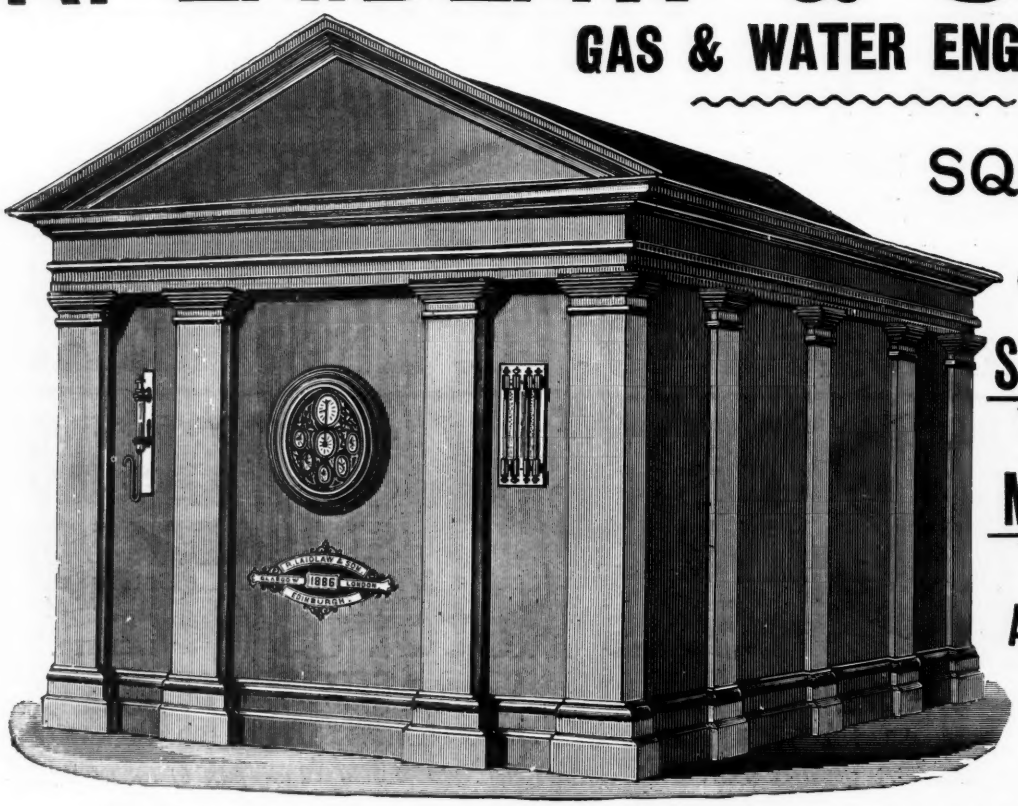

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"The New Incandescent (Sunlight Patent) Gas Lighting Company, Limited, hereby certify that the within Mantle is in every respect similar in process of Manufacture and constituent parts or substances to the Mantle which was held by the Hon. Mr. Justice Wills **NOT TO BE AN INFRINGEMENT OF THE WELSBACH PATENTS."**

AND WE FURTHER CALL ATTENTION TO THE EXTRACTS FROM THE JUDGMENT GIVEN BY THE HON. MR. JUSTICE WILLS, WHEN HE DISMISSED THE WELSBACH COMPANY'S APPLICATION FOR INJUNCTION:—

"No use is made by the Sunlight Company of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be **as wide asunder as the Poles** from those contemplated by Welsbach."

"Welsbach Company's Counsel, both admit that they have no case unless the Welsbach skeleton, of whatever resistant earth oxides composed, is within the Welsbach Patent. It seems to me that **this is just what Welsbach did not claim.**"

PRICE LIST AND TERMS ON APPLICATION.

THE NEW INCANDESCENT (SUNLIGHT PATENT) GAS LIGHTING Co., LIMITED,

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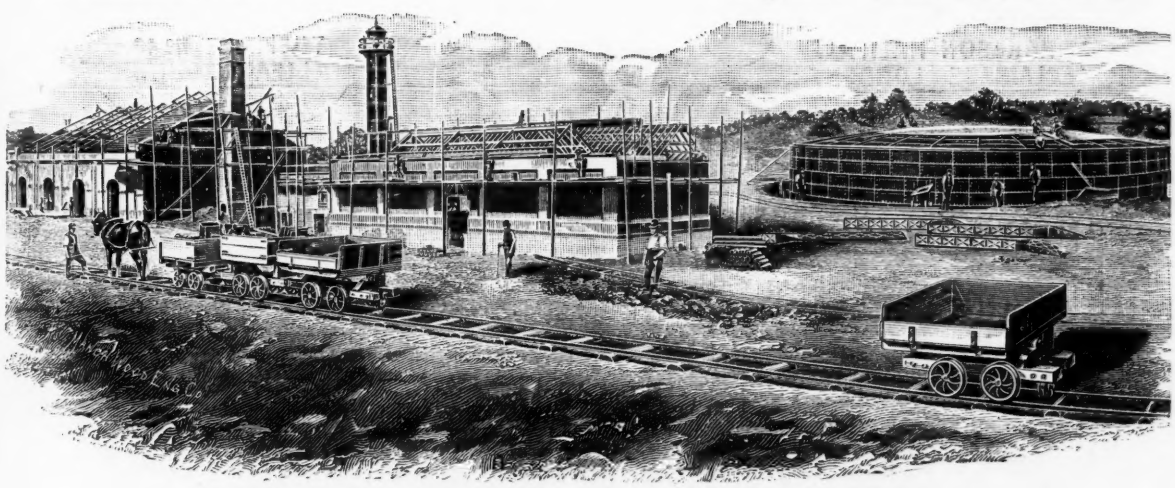

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[See Illustrated Advertisement, May 4, p. 1015.]

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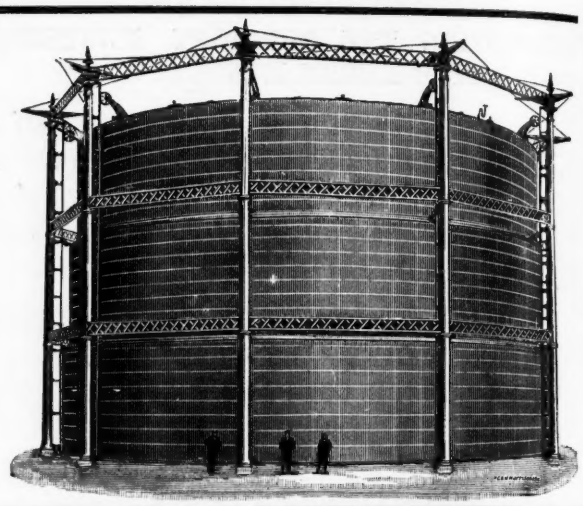

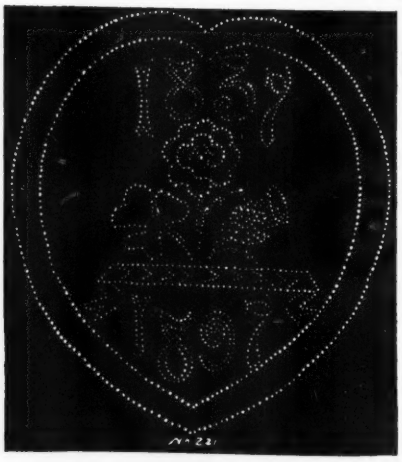

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[See Illustrated Advertisement, May 4, p. 1018.]

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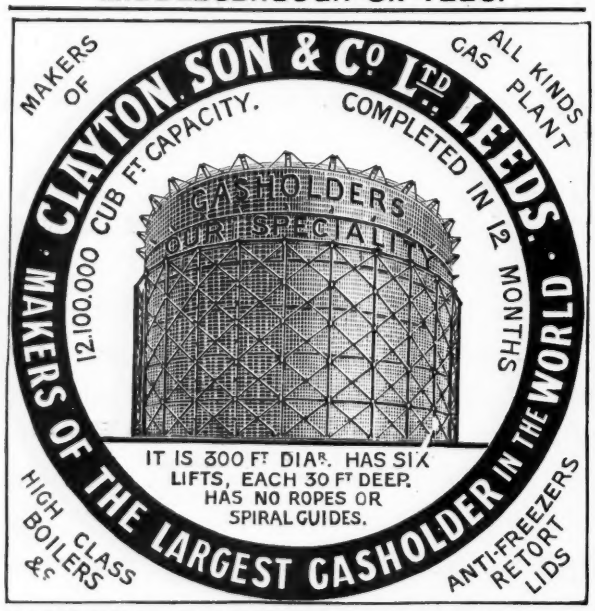
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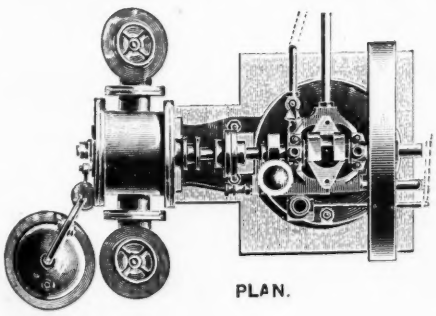

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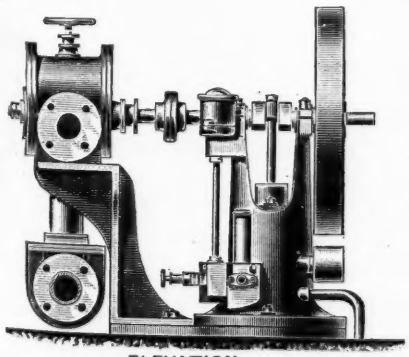

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[See also Advt. p. 1104.

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